From:	Carol McClelland Fields
To:	Coffin Butte Landfill Appeals
Subject:	Oppose/Deny LU-24-027 – Coffin Butte Landfill Impacts on Health - Carol McClelland Fields
Date:	Sunday, October 19, 2025 6:05:05 PM
Attachments:	Testimony - Oppose LU-24-027 - Carol McClelland Fields - Coffin Butte Impacts on Health - 10.19.2025.pdf 4 - EPA -Health Effects Attributed to Wildfire Smoke.pdf 2 - American Heart Assn - Where there's smoke, there's fire – and heart health risks.pdf 1 - Regional_Health_Assessment_final_draft_-_4.3.23.pdf 3 - National Insitute for Health - Wildfire smoke exposure and cardiovascular disease.pdf

---

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hello,

I've attached my testimony and supporting reference documents.

Please add them to the record for LU-24-027.

Two attached documents are too large to send in this email. I will send them in the next email with the same subject line.

Please note: Allow the large pdfs to fully populate before saving them. Otherwise the full documents are not saved and cannot be accessed.
Thank you.

Carol

--
~~~~~~~~~~~~~~~~~~~~~~~~~~

Carol McClelland Fields, PhD, BCC
541 243 3675
~~~~~~~~~~~~~~~~~~~~~~~~~~

Linn, Benton, and Lincoln Counties Regional Health Assessment 2022 - 2026

InterCommunity Health Network CCO

United Way of Linn, Benton & Lincoln Counties

Published 03/2023

Acknowledgements

This report was prepared by the Partnership for Community Health: Linn, Benton & Lincoln Counties (in alphabetical order):

April Holland, Benton County Health Department

Audrey Caro, Linn County Department of Health Services

Avalon Mason, Benton County Health Department

Brandan Kearney, Consultant with Samaritan Health Services

Charissa Young-White, InterCommunity Health Network Coordinated Care Organization

Christopher Sherrod, United Way of Linn, Benton & Lincoln Counties

Cristal Solorio, Linn County Department of Health Services

Cynthia De La Torre, Benton County Health Department

Dani Crabtree, Linn County Department of Health Services

Diego Nieto, Linn County Department of Health Services

Danielle Salazar, Linn County Department of Health Services

Elizabeth Herrera, Samaritan Health Services

Florence Pourtal, Lincoln County Public Health

Gayle Woodworth, Linn County Department of Health Services

Isabella Welsh, Benton County Health Department

JoAnn Miller, Samaritan Health Services

Johnna Peters, Benton County Health Department

Mac Gillespie, Benton County Health Department

Madelyn Hiner, Lincoln County Public Health

Marianne Seifert, Lincoln County Public Health

Mara Sargent, Benton County Health Department

Melissa Isavoran, InterCommunity Health Network Coordinated Care Organization

Paulina Kaiser, Samaritan Health Services

Peter Banwarth, Benton County Health Department

Rachel Petersen, Linn County Department of Health Services

Rebekah Fowler, InterCommunity Health Network Coordinated Care Organization

Ruby Moon, Confederated Tribes of Siletz Indians

Sara Hartstein, Benton County Health Department

Sara Herd, Lincoln County Public Health

Shelagh Baird, Samaritan North Lincoln Hospital

Shane Sanderson, Linn County Department of Health Services

Thomas Packebush, Benton County Health Department

Todd Noble, Linn County Department of Health Services

The Partnership for Community Health would also like to extend special thanks to our numerous community partners for their invaluable contributions (in alphabetical order):

ABC House
Acosta Services
Advantage Dental
Albany Mayor's Office
Arcoíris Cultural
Benton County Health Navigation Program
Benton County Natural Areas, Parks & Events
Boys & Girls Club of Albany
Boys & Girls Club of Corvallis
Casa Latinos Unidos
CASA of Linn County
Center Against Rape and Domestic Violence
City of Corvallis Parks & Recreation
Coastal Range Food Bank
Community Harm Reduction Mentors & Allies
Community Services Consortium
Corvallis Climbers of Color
Corvallis Environmental Center
Corvallis Multi-Cultural Literacy Center
Corvallis School District 509J Family Advocates
Faith Hope and Charity, Inc.
Family Tree Relief Nursery
FISH of Lebanon
Good Samaritan Regional Medical Center
Grace Wins Haven
Grupito Billingue
International Moms Group
Jackson Street Youth Services
Kepi Nak-Nak Resource Center
Lincoln County Behavioral Health
Lincoln County Developmental Disabilities
Lincoln County Library District
Lincoln County Sheriff's Office
Lincoln County Solid Waste District
Linn Benton Health Equity Alliance
Linn Benton NAACP
Mid Willamette Trans Support Network
Neighbors for Kids
Newport 60+ Activity Center
Newport Recreation Center
Olalla Center – Project Bravery
Oregon Cascades West Council of Governments, Meals on Wheels
Oregon Coast Community College Nursing
Oregon Department of Environmental Quality
Oregon State University
Oregon State University Basic Needs Center
Oregon State University Education Opportunities Program
Oregon State University Extension
Panther Creek Community Center
Parenting Success Network
Pathfinder Clubhouse
Philomath Pride
Reconnections Counseling
Samaritan Albany General Hospital
Samaritan Lebanon Community Hospital
Samaritan North Lincoln Hospital
Samaritan Pacific Communities Hospital
Senior Corps of Linn, Benton, and Lincoln Counties
South Benton Food Pantry
Strengthening Rural Families
Vina Moses Center
Volunteer Caregivers

Table of Contents

Acknowledgements i
Table of Contents iii
Table of Tables v
Table of Figures vii
Executive Summary 1
1 Introduction 2
Goals 2
Development Process 2
Methodology 3
Limitations 5
2 Who We Are 6
Health Equity 6
Population Size 7
Rural & Urban Areas 11
Language, Disability, and Demographic Characteristics 13
Students 14
3 Environmental Health 17
Air 17
Wildfires 18
Heat 20
Water 20
Solid Waste 22
Hazardous Waste 23
Neighborhood Environments 24
4 Social Determinants of Health 30
Economic Stability 30
Education 34
Food Insecurity 36
Emergency Food Support 38
Housing 38
5 Access to Health Services 42
Insurance Coverage 43
Provider Availability 45
Preventive Services 48
Oregon Health Plan (Medicaid): InterCommunity Health Network Coordinated Care Organization (IHN-CCO) 51
6 Morbidity and Mortality 53
Mortality 53
Leading Causes of Death 55
Tobacco-Related Mortality 57
Injury 58
Homicide 60
Chronic disease 60
Cancer 60
Heart Disease and Stroke 63
Infectious Illnesses (Non-COVID) 67

7 Healthy Youth & Families 70
Pregnancy & Infant Health 70
Birth Rate 70
Prenatal Care and Healthy Pregnancy 72
Prenatal Tobacco Use 73
Premature Birth and Low Birthweight 75
Teen Pregnancy 77
Breastfeeding 78
Child and Adolescent Health 79
Child Abuse 79
Youth Immunization Rates 81
8 Mental & Behavioral Health 83
Mental Health 83
Substance Use 88
Nutrition & Physical Activity 92
Oregon Health Plan (Medicaid): InterCommunity Health Network Coordinated Care Organization (IHN-CCO) 95
9 COVID-19 97
Case Rates 97
Hospitalizations 102
Mortality 103
Vaccination 105
10 Community Voices 109
Regional Community Health Survey 109
Qualitative Engagement Sessions 112
Focus Groups 112
Key Informant Interviews 112
11 Summary 114
Key Themes 114
Conclusion 116
Appendix 1: Acronyms used 117
Appendix 2: Annotated list of select data sources 118
Appendix 3: References 120

Table of Tables

Table 2-1: Population size by age group 10
Table 2-2: Percent of population by race 11
Table 2-3: Percent of population by ethnicity 11
Table 2-4: Population size for cities with more than 5,000 residents in the region 12
Table 2-5: Percentage of specific demographic characteristics by location 13
Table 2-6: Percentage of languages spoken at home by location 13
Table 2-7: Percent of population per age group with disability by location 14
Table 2-8: Percent of population with disability by disability type and location 14
Table 2-9: Number of enrolled students by education level and location 15
Table 2-10: Percent of students enrolled in K-12 by race/ethnicity and location 16
Table 2-11: Number of students enrolled in college (undergraduate) by race/ethnicity and location 16
Table 3-1: Air quality status by year and location 18
Table 3-2: Total acres burned in thousands over time in Oregon and Washington 19
Table 3-3: Number of high heat and extreme heat days by year and location of monitoring sites 20
Table 3-4: Contaminants levels above federal standards in community public water systems, by contaminant and location 21
Table 3-5: Cities with fluoridated community public water systems by county 22
Table 3-6: Percent of workforce 16 years and older by means of transportation to work and location 26
Table 4-1: Income inequality by location 31
Table 4-2: Percent of age categories living in poverty by location 32
Table 4-3: Percent of racial/ethnic groups below poverty level by location 32
Table 4-4: Median household income by race/ethnicity and location 33
Table 4-5: Highest educational level achieved among adults age 25 years and over by location 34
Table 4-6: Percent of high school students that graduate on time by race/ethnicity and location 35
Table 4-7: Use of WIC benefits by location 36
Table 4-8: Use of SNAP benefits by location 36
Table 4-9: Percent of population by home ownership status and location 38
Table 4-10: Demographics of the populations experiencing chronic homelessness by location 40
Table 4-11: Percent of the homeless population by race and location 41
Table 5-1: Percent of the population with health insurance coverage by age group and location 44
Table 5-2: Percent of the population with health insurance coverage by race/ethnicity and location 44
Table 5-3: Percent of the population with health insurance coverage by income level and location 45
Table 5-4: Number of mental health professionals per 10,000 people by location 47
Table 5-5: IHN-CCO Consumer Assessment of Healthcare Providers survey results 51
Table 6-1: Number of deaths per 100,000 people by age group and location 55
Table 6-2: Number of deaths per 100,000 people by leading causes of death and location 57
Table 6-3: Number of injury deaths per 100,000 people by leading causes of injury deaths and location 59
Table 6-4: Age adjusted number of cancer diagnoses per 100,000 people by cancer type and location 61
Table 6-5: Age-adjusted number of cancer deaths per 100,000 people by cancer type and location 62
Table 6-6: Number of deaths per 100,000 adults 35 and older from heart disease by race/ethnicity and location 64
Table 6-7: Number of deaths per 100,000 adults 35 years and older from stroke by race/ethnicity and location 65
Table 6-8: Age adjusted percent of adults with risk factors for heart disease and stroke by location 66
Table 7-1: Number of births per 1,000 population by maternal age group and location 71
Table 7-2: Number of births per 1,000 gestational parents by gestational parent's race/ethnicity and location 72
Table 7-3: Percent of pregnancies with inadequate or no prenatal care services by gestational parent's race/ethnicity and location 72

Table 7-4: Percent of pregnancies with inadequate or no prenatal care services by gestational parent's age group and location 73
Table 7-5: Percent of maternal prenatal tobacco use by maternal age 74
Table 7-6: Percent of newborns with low birthweight by maternal age group and location 76
Table 7-7: Percent of newborns with low birthweight by gestational parent's race/ethnicity and location 76
Table 7-8: Percent of premature births by gestational parent's age group and location 77
Table 7-9: Percent of premature births by gestational parent's race/ethnicity and location 77
Table 7-10: Percent of gestational parents who utilized WIC during the postpartum period by breastfeeding duration and location 79
Table 7-11: Percent of adolescents ages 13 to 17 immunized for specific diseases by location 82
Table 8-1: Percent of adult smokers by quit status and location 89
Table 9-1: Newly confirmed COVID-19 cases by age group and location 100
Table 9-2: Newly confirmed COVID-19 Cases by race/ethnicity and location 100
Table 9-3: Number of COVID-19 deaths per 100,000 people by location 105
Table 9-4: Number of COVID-19 vaccinations by location 106
Table 9-5: Number of people with at least one dose of a COVID-19 vaccination by rarest race/ethnicity and location 107
Table 9-6: Number of people with at least one dose of a COVID-19 vaccine by age group and location 108
Table 10-1: Demographic information from the 2,812 Community Survey respondents 110
Table 10-2: Perceived health status among Community Survey respondents 111
Table 10-3: Thematic groups from key informant interviews and their associated topics 112
Table 10-4: Percent of key informant responses by thematic group and location 113

Table of Figures

Figure 2-1: Visualizing health equity....7
Figure 2-2: Population by county and percent of regional population 8
Figure 2-3: Population pyramid for Benton County 8
Figure 2-4: Population pyramid for Lincoln County....9
Figure 2-5: Population pyramid for Linn County 9
Figure 2-6: Percent of population residing in urban and rural/frontier areas....12
Figure 3-1: Number of wildfires by year and location 19
Figure 3-2: The materials life cycle 23
Figure 3-3: Pounds of chemicals released from industrial facilities in toxic release inventory....24
Figure 3-4: Percent of people who live within half a mile of specific store types by location 27
Figure 3-5: Percent of homes built by year and location....27
Figure 3-6: Percent of population with access to exercise opportunities* by location....29
Figure 4-1: Centers for Disease Control and Prevention (CDC) graphic on social determinants of health 30
Figure 4-2: Percent of those with a disability living in poverty by location....33
Figure 4-3: High School graduation rate per 100 students by school year and location....35
Figure 4-4: Estimated percent of population experiencing food insecurity by year and location 37
Figure 4-5: Estimated percent of children under age 18 experiencing food insecurity by year and location....37
Figure 4-6: Percent of households experiencing housing burden by ownership status and location 39
Figure 4-7: Percent of households experiencing extreme housing burden by ownership status and location 39
Figure 4-8: Percent of students enrolled in K-12 experiencing homelessness....40
Figure 5-1*:* Percent of the population without health insurance by location 43
Figure 5-2. Primary care professionals per 10,000 people by location 46
Figure 5-3: Behavioral health professionals per 10,000 people by location 46
Figure 5-4: Number of oral health professionals per 10,000 people by location....48
Figure 5-5: Age-adjusted percent of adults who received cholesterol screening within the past five years by location....49
Figure 5-6: Age-adjusted percent of women ages 50-74 who received a mammogram within the past two years by location....49
Figure 5-7: Age-adjusted percent of adults who visited a doctor for a routine check-up within the past year by location....50
Figure 5-8: Age-adjusted percent of adults who visited the dentist within the past year by location....50
Figure 5-9: Percent of IHN-CCO members with a dental claim in the past year by age category and location 52
Figure 5-10: Percent of IHN-CCO members with at least one visit to an emergency department in the past year by location....52
Figure 5-11: Percent of IHN-CCO members with five or more visits to an emergency room in the past year by location....53
Figure 6-1: Number of deaths per 100,000 people by year and location (crude death rate) 54
Figure 6-2: Leading causes of death per 100,000 people comparison of Oregon and Linn-Benton-Lincoln Region...56
Figure 6-3: Age-adjusted number of deaths per 100,000 people related to tobacco use by location....58
Figure 6-4: Number of injury deaths per 100,000 people by location 59
Figure 6-5: Age-adjusted number of cancer diagnoses per 100,000 people by location 61
Figure 6-6: Age adjusted number of cancer deaths per 100,000 people by location....62
Figure 6-7: Age adjusted percent of adults who have ever experienced coronary heart disease or stroke by location 63
Figure 6-8: Number of deaths per 100,000 adults 35 years and older from heart disease or stroke by location 64
Figure 6-9: Number of deaths per 100,000 adults 35 and older from heart disease by gender and location 65
Figure 6-10: Number of deaths per 100,000 adults 35 and older from stroke by gender and location....66

Figure 6-11: Reported cases of campylobacteriosis per 100,000 people by year and location 68
Figure 6-12: Reported cases of E. coli per 100,000 people by year and location 68
Figure 6-13: Reported cases of chlamydia per 100,000 people by year and location 69
Figure 6-14: Reported cases of gonorrhea per 100,000 people by year and location 69
Figure 6-15: Reported cases of syphilis per 100,000 people by year and location 70
Figure 7-1: Number of births per 1,000 people by year and location 70
Figure 7-2: Percent of births in which tobacco was used during pregnancy by year and location 74
Figure 7-3: Percent of newborns with low birthweight by year and location 75
Figure 7-4: Teen pregnancy rate by location, 2018-2020.....78
Figure 7-5: Number of child abuse victims per 1,000 children by location 80
Figure 7-6: Family stress factors among founded abuse cases, Oregon.....80
Figure 7-7: Number of children in foster care per 1,000 children by location 81
Figure 7-8: Percent of two-year olds up to date with the 4:3:1:3:3:1:4 vaccine series by location 82
Figure 8-1: Age adjusted percent of adults who experienced 14 or more "not good" mental health days by location 84
Figure 8-2: Age adjusted percent of adults that report being diagnosed with depression by location 84
Figure 8-3: Percent of students who reported feeling sad or hopeless almost every day for 2+ weeks in a row by grade and location 85
Figure 8-4: Percent of students who reported being bullied at school in the last 30 days by grade and location 85
Figure 8-5: Age adjusted number of deaths by suicide per 100,000 people by year and location 86
Figure 8-6: Number of deaths by suicide per 100,000 people by age group and location.....86
Figure 8-7: Percent of students who reported seriously considering attempting suicide by grade and location.....87
Figure 8-8: Percent of students who reported attempting suicide by grade and location.....87
Figure 8-9: Percent of adults 18 years and older who smoke cigarettes by location 89
Figure 8-10: Percent of adults 18 years and older who binge drink by location 90
Figure 8-11: Number of accidental/undetermined deaths from drug overdose per 100,000 people by year and location 91
Figure 8-12: Percent of 8th grade students who reported ever using substances by substance and location 91
Figure 8-13: Percent of 11th grade students who reported ever using substances by substance and location 92
Figure 8-14: Age-adjusted percent of adults 18 and over reporting no leisure-time physical activity in the past month by location.....93
Figure 8-15: Percent of students who are physically active for at least 60 minutes per day by grade and location ..94
Figure 8-16: Percent of students who consume 5 or more servings of fruits and vegetables per day by grade and location 94
Figure 8-17: Percent of IHN-CCO members with a serious and persistent mental illness (SPMI)* diagnosis, by type and location 95
Figure 8-18: Percent of IHN-CCO members with a serious and persistent mental illness (SPMI)* who had an outpatient behavioral health visit by location.....96
Figure 9-1: Number of newly confirmed COVID-19 cases in Benton County by date 98
Figure 9-2: Number of newly confirmed COVID-19 cases in Lincoln County by date.....98
Figure 9-3: Number of newly confirmed COVID-19 cases in Linn County by date 99
Figure 9-4: Number of COVID-19 hospital admissions in Benton County over time 102
Figure 9-5: Number of COVID-19 hospital admissions in Lincoln County over time 103
Figure 9-6: Number of COVID-19 hospital admissions in Linn County over time 103
Figure 9-7: Number of COVID-19 deaths in Benton County over time.....104
Figure 9-8: Number of COVID-19 deaths in Lincoln County over time 104
Figure 9-9: Number of COVID-19 deaths in Linn County over time.....105
Figure 10-1: High priority issues from Community Survey respondents 111

Executive Summary

The Partnership for Community Health conducted this Regional Health Assessment (RHA) to better understand the health-related issues affecting the Linn, Benton, and Lincoln (LBL) region. This report includes data from a variety of local, state, and national data sources including both secondary data (surveys and data collection systems reported publicly) and primary data (new data collected from our community specifically for this assessment).

In the 2022 County Health Rankings, Benton County ranked 1st among Oregon counties for health outcomes (including measures of length of life and quality of life) and 2nd for health factors (including health behaviors, clinical care, social and economic factors, and physical environment).[1] Linn County was ranked in the middle of the 35 Oregon counties that received a ranking (16th for health outcomes and 17th for health factors) while Lincoln County ranked 27th for health outcomes and 33rd for health factors. These summary rankings highlight the variability within the LBL region as well as the potential opportunities to improve community health.

After a thorough review of available secondary data sources and gathering input from community members via a variety of primary data collection activities, the following key themes emerged:

Key Health Themes from the 2022 - 2026 Regional Health Assessment (in alphabetical order)

Access to Affordable Housing & Homelessness: high prevalence of homelessness and financial burden due to housing costs.

Access to Quality Care: inadequate access to primary care physicians, behavioral health providers, and dentists.

Equity, Diversity & Inclusion: minoritized racial and ethnic groups and people living with disabilities (and likely other vulnerable populations not adequately identified in available data) experience more challenges than able-bodied White individuals.

Food Insecurity & Access: high rates of food insecurity and limited access to grocery stores.

Healthy Youth & Families: teen pregnancy, prenatal tobacco use, child abuse, and high number of children in foster care.

Mental Health: high rates of depression and suicide; high rates of feeling sad or hopeless among high school students.

Substance Use and Misuse: drug overdoses; teen use of e-cigarettes, alcohol, and prescription drugs.

1 Introduction

The 2022 - 2026 Linn, Benton, and Lincoln County Regional Health Assessment (RHA) is the result of many dedicated hours of research and collaboration between the Partnership for Community Health and agencies, leaders, and local residents across all three counties. A community health assessment provides comprehensive information about a community's health status, needs, and issues. The Partnership for Community Health recognizes that health is influenced by a wide range of conditions and factors. As such, the RHA presents information on numerous indicators, ranging from those commonly understood to impact health status, such as access to health care, to those whose link is less widely understood, such as education levels. This is an effort to recognize that health starts long before illness occurs and is impacted by where and how we live, learn, work, play, and pray.

This report is focused on describing the health trends, environmental conditions, and disparities affecting residents in recent years. Assessing health status and risk factors is a key foundation for informing plans for community health improvement, aligning priorities among regional stakeholders, and indicating health status trends.

Goals

Linn, Benton, and Lincoln counties are distinct areas with attractions that set them apart from one another and the state of Oregon as a whole. Despite these differences, the three counties also have many identifiers that make a regional approach to conducting a community health assessment valuable and reasonable. A regional approach allows for the identification of wider health trends that may promote or inhibit the health of those living in each of the three counties. Additionally, this regional approach allows all three counties to pool resources and to strengthen relationships, which can be leveraged for future activities. Due to the three counties' proximity, there are numerous organizations whose work extends beyond the confines of county lines to serve the LBL region in sectors including health care, social services, and more. It is also not uncommon for residents of one of the three counties making up the LBL region to frequent another for work, resources, or recreation.

This report is intended to:

- Describe the current health status and disparities affecting residents in LBL region;
- Identify areas of strength and weakness in terms of health status and access to resources; and
- Summarize available data to support collaborative alignment and decision-making among health stakeholders.

Development Process

The process of drafting the regional health assessment was guided by the Partnership for Community Health, a steering committee composed of stakeholder organizations. These organizations include the health departments of Linn, Benton, and Lincoln counties, Confederated Tribes of Siletz Indians, InterCommunity Health Network Coordinated Care Organization (IHN-CCO), Samaritan Health Services, and United Way of Linn, Benton & Lincoln Counties. See the Acknowledgments section of this report for a detailed list of participants. The Partnership for Community Health met monthly starting in September

2021 to plan and implement the regional health assessment. Additionally, two workgroups were established to coordinate specific efforts: the data workgroup and the engagement workgroup. The data group met biweekly from November 2021 through June 2022, with additional ad hoc meetings as needed after June. The data workgroup focused on identifying secondary data sources and creating relevant tables/figures to include in the chapters below. The engagement workgroup met biweekly from November 2021 through December 2022. The engagement workgroup focused on soliciting community input about community health through the community health survey, key informant interviews, and focus groups (see Chapter 10: Community Voices).

Methodology

Population-Level Data Sources

Most of the data presented in this report comes from publicly available secondary sources. An annotated list of the major data sources used throughout this report is available in Appendix 2. Data are reported separately by county where available.

We started by generating a list of health-related topics based on prior community health assessments, with additional topics identified as relevant (e.g., COVID-19). We looked for data sources available at the county level and excluded data collected prior to 2019.

In all tables and figures, nominal response categories are presented in alphabetical order. All tables and figures include a caption identifying the data source, the time period captured in the data, and a link to a relevant website.

We present age-adjusted numbers where possible to minimize the differences between counties due to different age distributions of the population. As shown in

Figure 2-3 and Figure 2-4, Benton County's population skews younger due to the large number of college students at Oregon State University while Lincoln County tends to be older due to retirees settling on the coast. Not all data sources had age-adjusted numbers available; for example, Chapter 6: Morbidity and Mortality includes the rates of leading causes of death using crude mortality rates (Table 6-2). As expected, the differences between counties are much larger using crude mortality rates than using age-adjusted mortality rates (for example, in Figure 6-6).

Community Voices

We gathered primary data from community members through a community health survey, focus groups, and key informant interviews.

Community Health Survey

The Community Survey was drafted to solicit input from anyone who lives, works, goes to school or spends time in Linn, Benton or Lincoln counties. The survey asked respondents to review a list of 30 different health-related topics, and assign each topic a rating corresponding to the degree of attention that issue should receive: 'least attention,' 'some attention', 'most attention,' or 'don't know.' The

survey also included a few questions about the respondent's demographic information and overall assessment of health of the community and health of the respondent.

The Community Survey was distributed in both paper and electronic methods. Paper copies were distributed to community partners, including versions translated into Arabic, Chinese, Korean, Russian, Spanish, and Vietnamese. Paper copies were also made available at popular community gathering spaces and some public events. The survey was also available via SurveyMonkey link for electronic distribution, which was advertised on partner social media sites and sent out via email.

Responses from the Community Survey were analyzed descriptively, as the use of convenience sampling means that the results are not representative of the general population.

Qualitative Data Collection

A variety of focus groups and key informant interviews were held across the region to solicit input from a broad range of community representatives, including under-represented populations. Conversation followed a semi-structured protocol, guided by 1-2 facilitators. Focus groups occurred via both in person and virtual formats. Participants gave permission for focus groups to be recorded and later transcribed. The following organizations and/or specific population groups participated in focus groups:

- African-American / Black focused
- Arabic Speakers
- Community Harm Reduction Mentors & Allies
- Esperanza para las Madres (Spanish-speaking moms living with depression)
- Grace Wins
- Grupito Billingüe (Spanish-English bilingual parent group)
- Guatemalan Immigrants and Mam-speakers
- Iglesia Bautista
- International Moms Group
- Oregon State University (OSU) Extension Nutrition Group
- OSU Basic Needs Center
- Panther Creek Echo Mountain wildfire survivors
- Parenting Success Network: Haga de la familia un placer
- Spanish-speaking farm workers
- Spanish Speakers
- Strengthening Rural Families

Additionally, 31 key informant interviews were conducted throughout the region with a diverse set of partners representing community-based organizations, cultural organizations, and decision-makers. Interviewees are not named to protect anonymity.

Analysis of the qualitative data included transcription of focus group recordings; identification of themes based on review of notes/transcripts by multiple reviewers; discussion to reach consensus on a final list of recurring themes; and then counting the total number of times each theme came up in focus groups and in key informant interviews. Results of the qualitative data collection are presented in Chapter 10: Community Voices.

Limitations

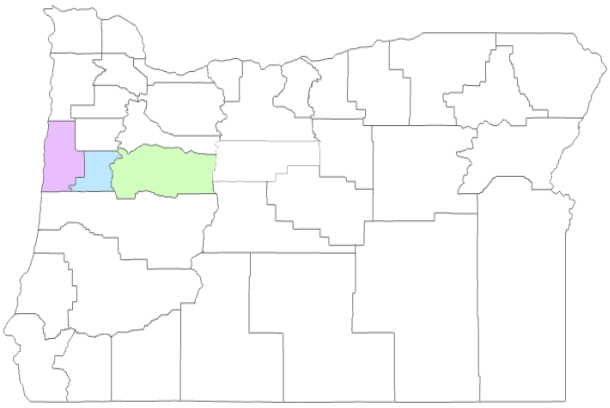
While the Regional Health Assessment identifies many critical issues pertaining to health in the region, it will never be fully comprehensive. This report should not be considered a formal study or research document investigating the causes of each issue raised or providing a detailed analysis of the data. In many cases, data are not available at the regional or county level, nor are all data stratified by race/ethnicity, income, education level, zip code, etc. Data that describe the many factors that contribute to health are not always readily available. In addition, conclusions, hypotheses, and interpretations of the interactions between the many factors that contribute to health may not be included, in part because the underlying structures of these interactions are still not fully understood.

Recognizing and highlighting the need for more detailed local data was a key objective of this assessment. As mentioned above (and throughout the document) data for Linn, Benton, and Lincoln counties were often not available for specific demographics, such as age, income, education-level, race/ethnicity, preferred language, or zip code. This greatly limited the ability to explore differences or disparities within specific sub-populations or geographies. When race/ethnicity data are gathered, analysis may be further limited due to a lack of data stratification by more specific racial categories, such as United States-born versus foreign-born for the Latino population, or the many ethnicities and cultures represented in the category of Asian Pacific Islander. There are limited data on populations that experience inequities and disparities in the region however, as highlighted in later chapters, and their needs and barriers to health and health care are likely to be greater than those of the population at large.

Throughout the document, national or Oregon state-wide data are provided to illustrate trends, especially among vulnerable populations, when county level or regional data are not available. It is important to note, however, that national or state-wide rates, trends, and patterns may not necessarily reflect the reality of specific communities, counties, or regional rates and trends. As regional partners continue to gather information to inform their practices and services, it is important to collect demographic data (i.e., zip codes, level of education, etc.) so that more accurate information can be used to inform future health improvement planning and other public health initiatives.

2 Who We Are

Benton, Lincoln, and Linn counties span approximately 3,946 square miles and are currently home to approximately 268,700 residents.[2]



For thousands of years, the land comprising the three counties was home to a variety of Native American tribes.[3] In the 1840s, European settlers began to move west and displace the tribes. In 1855, the United States established a 1.3-million-acre reservation in what is now Lincoln County. Lincoln County remains the home of the Confederated Tribes of Siletz Indians.[4]

Today, the Linn, Benton, and Lincoln (LBL) region is a mixture of urban and rural areas and encompass diverse populations that vary widely in health and social needs.

Benton County is home to Oregon State University (OSU). OSU is the largest public university in Oregon and currently enrolls approximately 24,000 undergraduate and 5,000 graduate students.[5] Benton County has a variety of recreational assets and outdoor spaces, including several trail systems to improve the health and recreation benefits for community members. In addition, Benton County is considered a regional health care hub and is home to agriculture and growing technology industries.

Lincoln County is located along the Central Oregon Coast and, in many ways, it benefits from its proximity to the Pacific Ocean. As a coastal community, Lincoln County's economy and attractions are vastly different than that of both Linn and Benton counties. Lincoln County contains the cities of Newport and Lincoln City, which are major tourism destinations, especially during the summer months when tourists flock to the county's miles of public beaches. Newport is one of two major fishing ports in Oregon and the county has a rich fishing history. Industries including accommodation and food services, retail, and health care and social assistance are drivers of the local economy.[6]

Linn County is the largest and most populous of the three counties and is located in the heart of the Willamette Valley. Linn County is a significant agricultural producer and is one of the main distributers of grass seed in the world. Linn County has additional industries in manufacturing and forestry and a growing health sector. Linn County has a plethora of outdoor recreation opportunities for community members to enjoy.

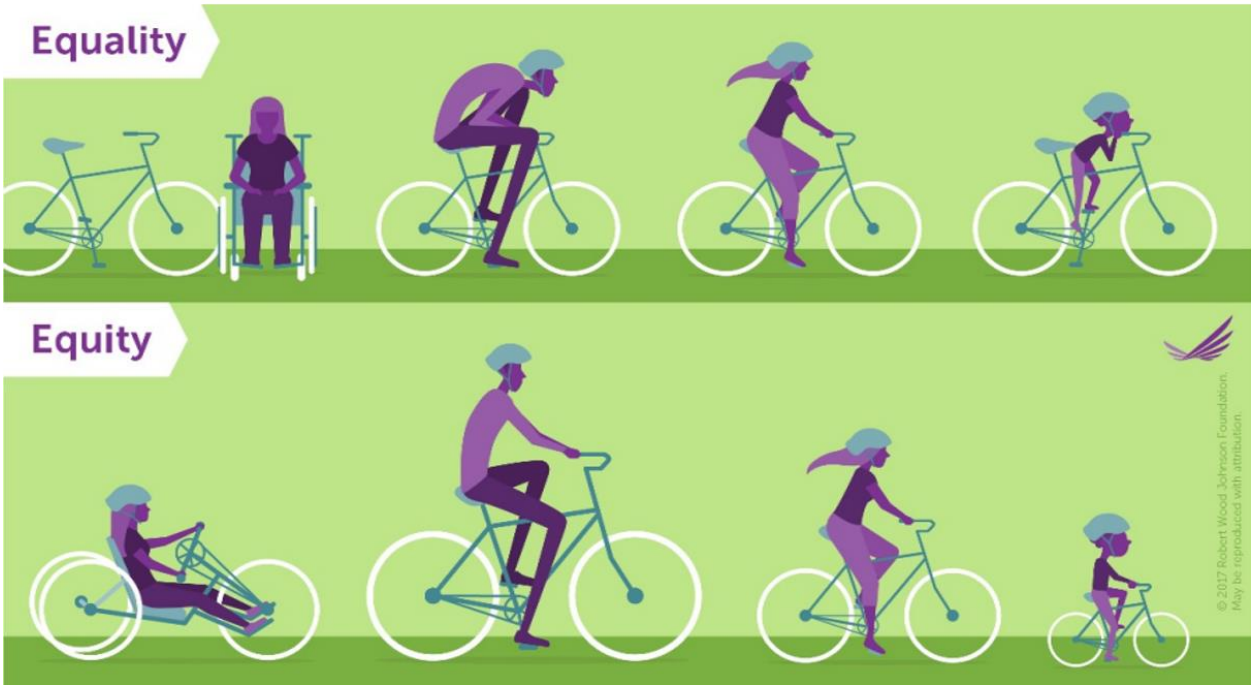
Health Equity

In discussing the health of our region, it is important to recognize that specific subpopulations may experience worse health outcomes than the general population. This chapter describes many of the sub-populations that will appear later in a health equity context. To understand the impact of these inequities, it is helpful to understand the variety of demographic characteristics represented in the LBL

region. This chapter includes information about geographic distribution, age, disability status, race and ethnicity, veteran status, and other categories.

Figure 2-1 defines equity by comparing it to equality. The top image shows equality, which is when everyone is given the same resources regardless of need. In this image, everyone has the same bike, but only the third person can ride the bike comfortably. The bottom image shows equity, in which we recognize that each person has different circumstances and needs. In this image, everyone is given the bike they need to ride comfortably. The goal of Partnership for Community Health is to promote equity across the region, recognizing that not everyone has the same opportunity to achieve health.

Figure 2-1: Visualizing health equity

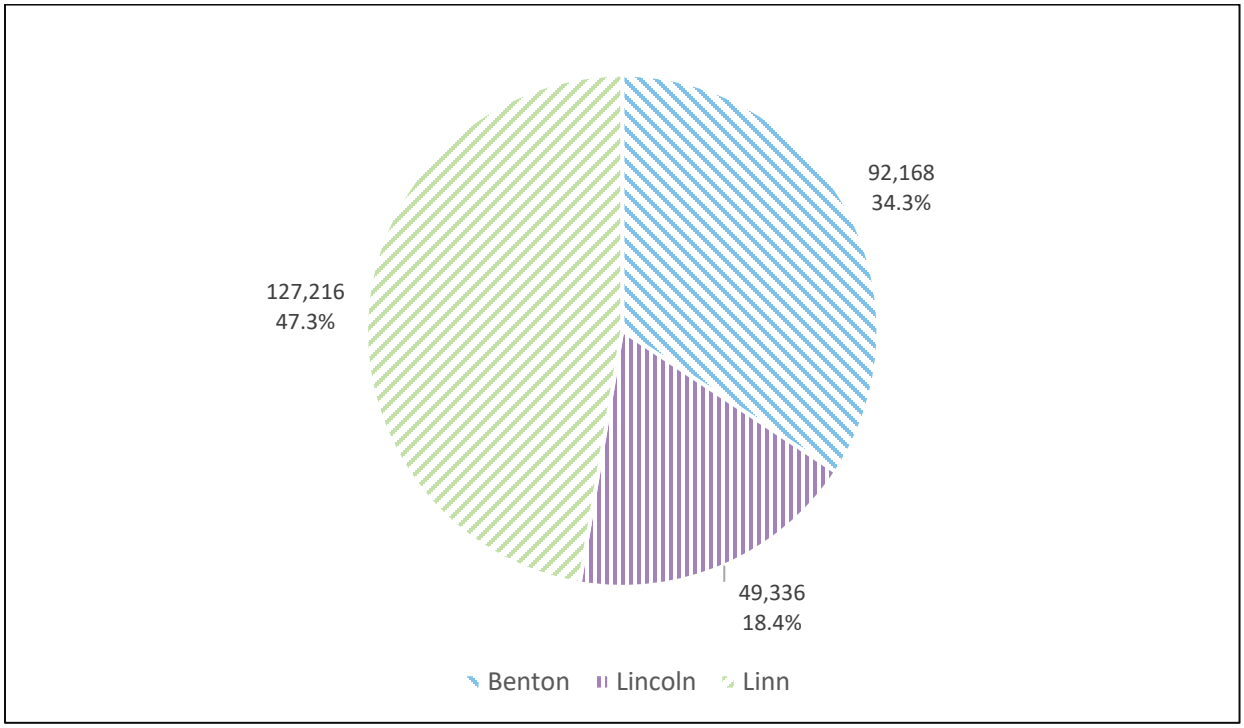


Source: Robert Wood Johnson Foundation
For more information: https://www.rwjf.org/en/insights/our-research/infographics/visualizing-health-equity.html

Population Size

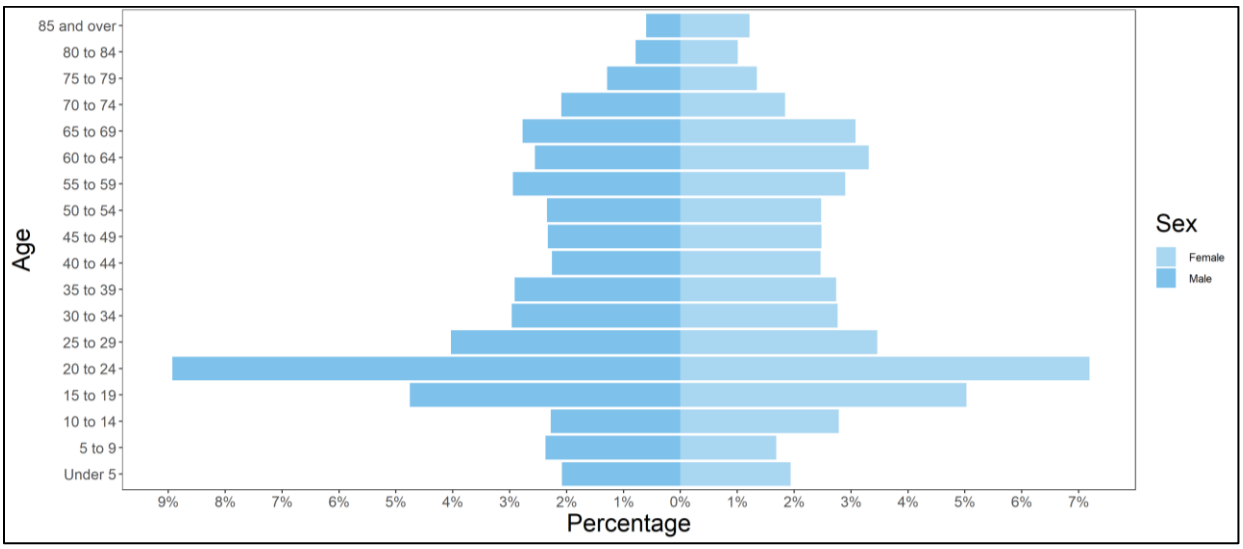
The LBL region is home to approximately 268,700 individuals. Linn County has the largest population with 127,216 individuals, followed by Benton County at 92,168 and Lincoln County at 49,336 individuals.[7] Within Benton County, the largest percentage of population is age 20 to 24, presumably from the large student population who attend Oregon State University. Lincoln County's largest percentage of population falls within the older age group of 60 to 69. Within Linn County, the percentage of population is spread out rather evenly between all age groups. The LBL region on average is racially/ethnically less diverse than the state of Oregon.

Figure 2-2: Population by county and percent of regional population



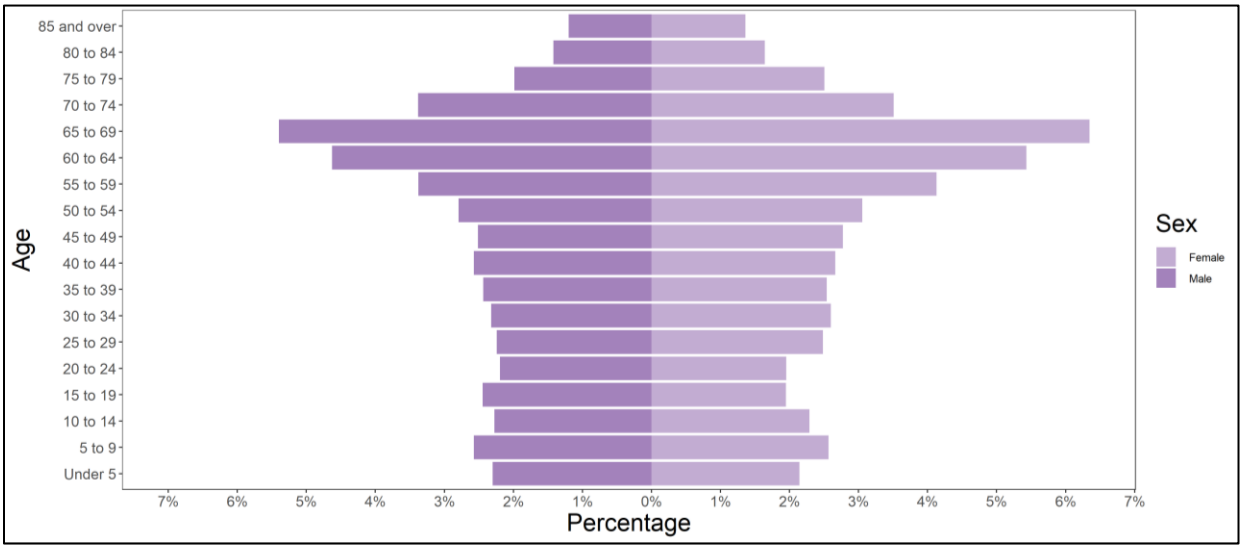
Data source: United States Census Bureau, America Community Survey, Table B01001
Time period: 2016-2020
For more information: https://data.census.gov/

Figure 2-3: Population pyramid for Benton County



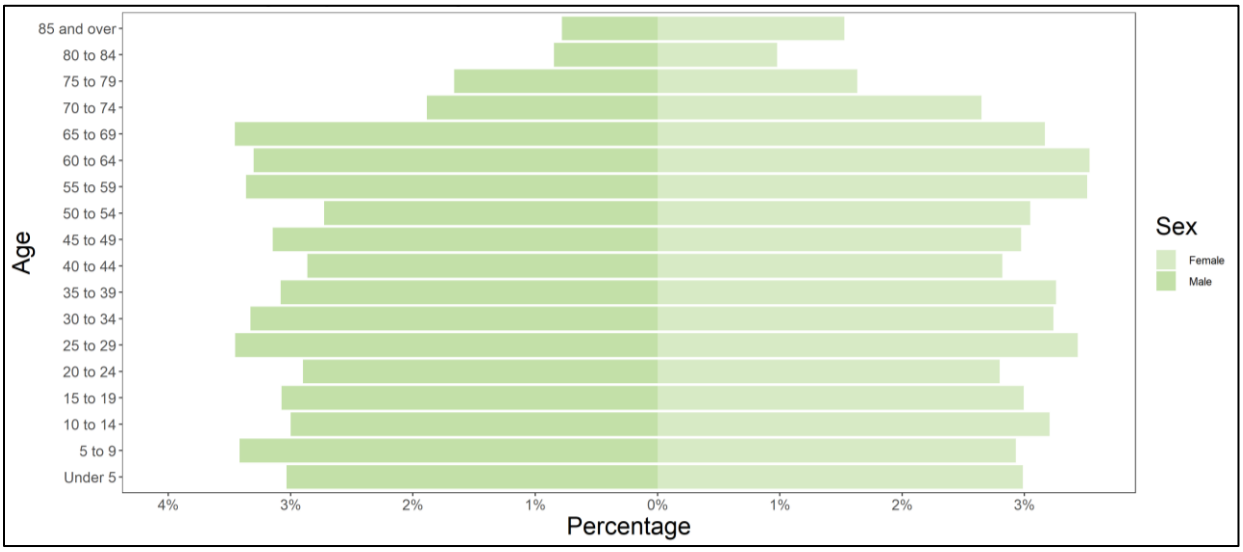
Data source: United States Census Bureau, America Community Survey, Table B01001
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Figure 2-4: Population pyramid for Lincoln County



Data source: United States Census Bureau, America Community Survey, Table B01001
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Figure 2-5: Population pyramid for Linn County



Data source: United States Census Bureau, America Community Survey, Table B01001
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 2-1: Population size by age group

Age Category	Benton	Lincoln	Linn	Oregon
Under 5	4.0%	4.4%	6.0%	5.5%
5-9	4.1%	5.1%	6.3%	5.8%
10-14	5.1%	4.6%	6.1%	6.0%
15-19	9.8%	4.4%	6.1%	5.9%
20-24	16.1%	4.1%	5.7%	6.4%
25-29	7.5%	4.7%	6.9%	7.1%
30-34	5.7%	4.9%	6.6%	7.1%
35-39	5.6%	5.0%	6.3%	6.9%
40-44	4.7%	5.2%	5.7%	6.5%
45-49	4.8%	5.3%	6.1%	6.3%
50-54	4.8%	5.8%	5.8%	6.0%
55-59	5.8%	7.5%	6.9%	6.3%
60-64	5.9%	10.1%	6.8%	6.7%
65-69	5.9%	11.7%	6.6%	6.2%
70-74	3.9%	6.9%	4.5%	4.5%
75-79	2.6%	4.5%	3.3%	2.9%
80-84	1.8%	3.1%	1.8%	1.9%
85+	1.8%	2.6%	2.3%	2.1%

Data source: United States Census Bureau, America Community Survey, Table S0101
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 2-2: Percent of population by race

Race	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	0.7%	2.5%	0.9%	1.1%
Asian	7.4%	1.1%	1.1%	4.5%
Black or African American	1.1%	0.3%	0.5%	1.9%
Native Hawaiian or Pacific Islander	0.2%	0.2%	0.1%	0.4%
Some Other Race	2.2%	3.0%	3.1%	3.4%
Two or More Races	4.9%	5.8%	5.4%	6.2%
White	83.4%	87.1%	88.8%	82.6%

Data source: United States Census Bureau, America Community Survey, Table B02001
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 2-3: Percent of population by ethnicity

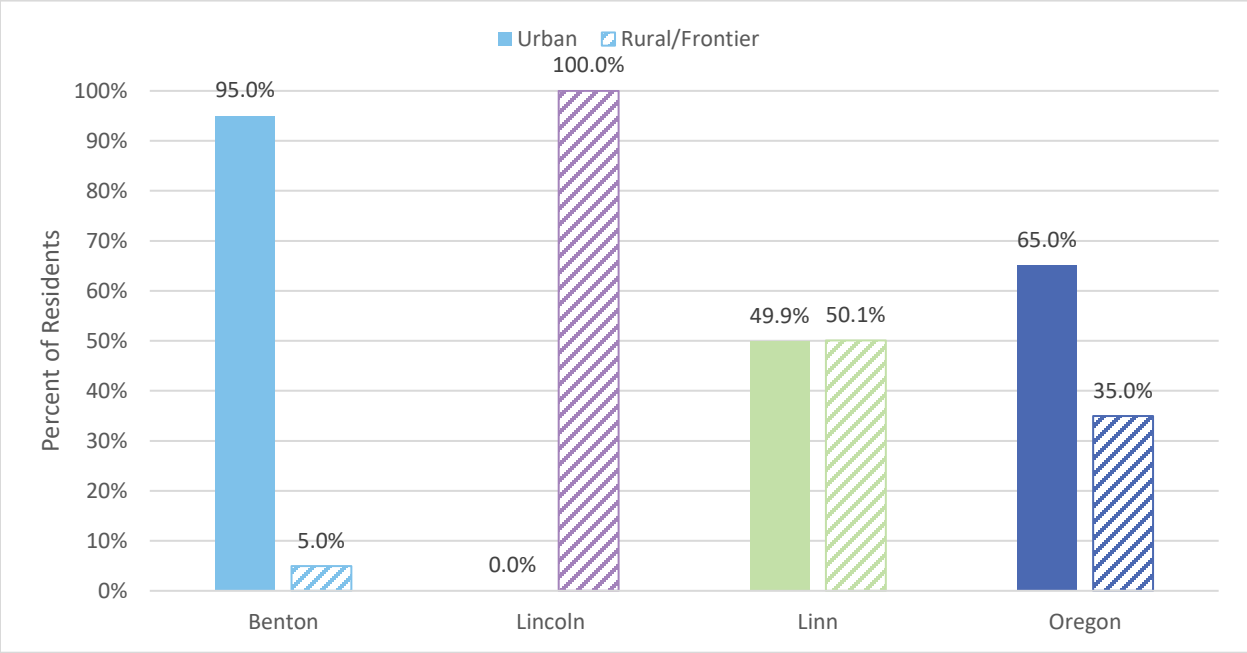
Ethnicity	Benton	Lincoln	Linn	Oregon
Hispanic or Latino	7.6%	9.4%	9.4%	13.2%
Not Hispanic or Latino	92.4%	90.6%	90.6%	86.8%

Data source: United States Census Bureau, America Community Survey, Table B03001
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Rural & Urban Areas

The Oregon Office of Rural Health sets designations for urban, rural, and frontier Oregon areas. Rural is defined as any geographic area in Oregon ten or more miles from the middle of a population center of 40,000 people of more. Frontier is defined as any county with six or fewer people per square mile.8 65% of Oregon's population live in urban areas, 33% live in rural areas, and 2% live in frontier areas. Figure 2-5 shows the distribution of urban and rural areas by county. All cities/towns in Lincoln County are defined as rural whereas both Benton and Linn counties have urban and rural designations (no areas in Benton, Lincoln, or Linn counties are classified as frontier areas).

Figure 2-6: Percent of population residing in urban and rural/frontier areas



Data source: Oregon Office of Rural Health and Annual Population Report Tables, Portland State University Population Research Center
Time period: 2020
For more information: https://www.ohsu.edu/oregon-office-of-rural-health/about-rural-and-frontier-data

Table 2-4: Population size for cities with more than 5,000 residents in the region

Name	County	Population
Corvallis	Benton	57,601
Albany (excluding North Albany)	Linn	47,877
Lebanon	Linn	19,122
Newport	Lincoln	10,591
Lincoln City	Lincoln	10,067
Sweet Home	Linn	9,893
Albany (North Albany only)	Benton	9,322
Philomath	Benton	5,682

Data source: Annual Population Report Tables, Portland State University Population Research Center
Time period: 2021
For more information: https://www.pdx.edu/population-research/population-estimate-reports

Language, Disability, and Demographic Characteristics

Understanding the region's language, disability, and demographic characteristics offers the potential for advancements in health equity and improvements in health outcomes for diverse populations. Linn and Lincoln counties have a higher percentage of veterans when compared to Benton County and Oregon. Benton County has a larger foreign-born population than do both Linn and Lincoln counties, possibly due to Oregon State University (OSU), which attracts many international students. Both Linn and Lincoln counties have a greater percentage of residents ages five and older with a disability when compared to Benton County and Oregon. Additionally, the type of disability most seen varies significantly from one county to another.

Table 2-5: Percentage of specific demographic characteristics by location

	Benton	**Lincoln**	**Linn**	**Oregon**
Foreign born	9.9%	4.8%	4.2%	9.8%
Veterans	6.3%	12.9%	10.2%	8.3%

Data source: United States Census Bureau, America Community Survey (foreign born: Table DP02; veteran status: Table S2101)
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 2-6: Percentage of languages spoken at home by location

	Benton	**Lincoln**	**Linn**	**Oregon**
English only	86.3%	92.7%	91.8%	84.7%
Spanish	5.0%	5.6%	6.4%	8.9%
Other Indo-European languages	2.3%	0.9%	1.0%	2.6%
Asian and Pacific Islander languages	5.6%	0.6%	0.7%	3.2%
Other languages	0.9%	0.1%	0.1%	0.7%

Data source: United States Census Bureau, America Community Survey, Table S1601
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 2-7: Percent of population per age group with disability by location

Age	Benton	Lincoln	Linn	Oregon
Under 5 years	0.4%	0.0%	0.0%	0.7%
5 to 17 years	4.8%	7.9%	7.0%	6.2%
18 to 34 years	7.6%	12.9%	11.3%	8.4%
35 to 64 years	10.5%	22.2%	17.1%	13.6%
65 to 74 years	18.4%	30.1%	31.1%	26.0%
75 years and over	42.9%	51.4%	51.7%	49.6%

Data source: United States Census Bureau, America Community Survey, Table S1810
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 2-8: Percent of population with disability by disability type and location

Disability Type	Benton	Lincoln	Linn	Oregon
Hearing difficulty	3.9%	6.4%	6.0%	4.6%
Vision difficulty	1.7%	4.4%	2.8%	2.4%
Cognitive difficulty	5.1%	8.2%	7.5%	6.2%
Ambulatory difficulty	4.4%	12.4%	9.2%	7.0%
Self-care difficulty	1.9%	3.9%	23.8%	2.7%
Independent living difficulty	4.5%	8.5%	7.0%	6.1%

Data source: United States Census Bureau, America Community Survey, Table S1810
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Students

There are four institutions of higher learning in the LBL region: Oregon State University (OSU), Linn-Benton Community College (LBCC), Western University of Health Sciences Oregon (WesternU Oregon), and Oregon Coast Community College (OCCC).

Oregon State University (OSU) is located in Corvallis and draws people from all 50 states and more than 100 countries.[9] In fall 2022, OSU had a record-high enrollment of 35,239 students.[10] Linn-Benton Community College (LBCC) is based out of Albany, with additional campuses in Corvallis, Lebanon, and Sweet Home. LBCC had 6,451 students enrolled in fall 2022. Most of these students were enrolled in

classes held in Linn County, where LBCC's main campus is located. Considering dual enrollment with OSU and LBCC student populations, these figures may be subject to a small portion of double counting. Western University of Health Sciences Oregon (WesternU Oregon) has a campus in the Linn County city of Lebanon. WesternU Oregon offers a Doctor of Osteopathic Medicine program (through the College of Osteopathic Medicine of the Pacific – Northwest [COMP-NW]), Doctor of Physical Therapy program, and in 2023, the college will welcome its first occupational therapy students. WesternU enrollment for 2023 is projected to be 108 Doctor of Osteopathic Medicine students, 60 Doctor of Physical Therapy students, and 45 occupational therapy students. Oregon Coast Community College (OCCC) has locations in Lincoln City, Newport, and Waldport, all of which are in Lincoln County. During the fall 2022 term, OCCC had an enrollment of 933 students, the majority of which were enrolled in non-credit training and personal enrichment courses.

Education level is a strong predictor of health and will be explored further in Chapter 4: Social Determinants of Health. Benton County has a disproportionate number of students enrolled in college/graduate school when compared with Lincoln and Linn counties (Table 2-9).

Table 2-9: Number of enrolled students by education level and location

Education Level	Benton	Lincoln	Linn	Oregon
Students enrolled in early education	1,027	414	1,111	55,409
Students enrolled in K-12	11,162	6,111	19,954	627,934
Students enrolled in college/graduate school	21,248	1,737	5,574	264,831

Data source: United States Census Bureau, America Community Survey, Table S1401
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 2-10: Percent of students enrolled in K-12 by race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	0.7%	4.5%	1.1%	1.2%
Asian	3.6%	0.7%	0.9%	4.0%
Black or African American	1.1%	0.5%	0.9%	2.3%
Hispanic or Latino	16.2%	23.9%	16.0%	25.0%
Multi-racial	8.2%	9.1%	7.2%	7.1%
Native Hawaiian or Pacific Islander	0.4%	0.2%	0.3%	0.8%
White	69.7%	61.0%	73.5%	59.7%

Data source: Oregon Department of Education, Fall Membership Report
Time period: 2021-2022
For more information: https://www.oregon.gov/ode/reports-and-data/students/Pages/Student-Enrollment-Reports.aspx

Table 2-11: Number of students enrolled in college (undergraduate) by race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	101	6	35	2,107
Asian	2,052	15	134	17,401
Black or African American	332	0	28	6,154
Hispanic or Latino	1,455	154	592	33,014
Multi-racial	1,159	72	378	17,948
Native Hawaiian or Pacific Islander	101	0	18	1,178
White	13,449	1,006	3,654	160,427

Note: includes community college students
Data source: United States Census Bureau, America Community Survey, Table B14007A-B14007E, B14007G, B14007I
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

3 Environmental Health

The environments in which we live, work, learn, play and pray impact our health and well-being. The air we breathe, the water we drink, and the neighborhoods we live in can all promote or diminish health. Climate change impacts all of these and can also have direct impacts on health through impacts on mental health.

Climate impacts on our mental health include increased anxiety and depression, post-traumatic stress disorder, substance abuse for coping, and strains on social relationships. Climate anxiety, also called eco-anxiety, is an overwhelming sense of fear, sadness and dread in the face of a warming planet. Elderly and children, those with preexisting mental illness, mobility impaired, indigenous, Black and Latinx people, migrants and refugees, and those with close ties to the land are at higher risk.[11]

The full impact of climate change on the region is complex and interconnected. The effects of climate change in Western Oregon are expected to include heat waves, more precipitation in the winter and less in the summer, decreased snowpacks and increased drought, and increased frequency and intensity of both wildfires and floods. Historical and contemporary inequities will place the greatest burden of these changes on racially diverse and low-income communities. For a full accounting of the scientific consensus on climate change in Oregon, see the Oregon Climate Assessment published January 5, 2021.

Air

Poor air quality can exacerbate chronic conditions like asthma and can increase the likelihood of acute cardiac events like heart attacks. Individuals who are unable to remain indoors where air can be filtered have greater exposure to air pollution. These populations include farmworkers, road workers, individuals experiencing homelessness, and people who live in housing with inadequate air conditioning and may need to keep windows open during the hottest months of the year.

Fortunately, air quality is usually good or moderate in the LBL region, except during wildfire season (Table 3-1). Air quality is most often measured by the concentration of microscopic particles called particulate matter (PM) in the air. The major source of particulate matter in Oregon is from wildfire smoke, with a smaller portion coming from transportation and wood fireplaces. Particles less than 2.5 microns (PM2.5) in diameter can penetrate lungs and cause or exacerbate health problems. Wildfire smoke from other counties and states impact our local air quality. With climate change, wildfire season is becoming longer, and the risk of larger wildfires is increasing.

Oregon's Air Quality Index reports how clean the air is and provides information on potential health risks. It is based on three pollutants regulated by the federal Clean Air Act: ground-level ozone, particle pollution and nitrogen dioxide. The highest of the AQI values for the individual pollutants becomes the AQI value for that day. These are usually particulate pollution in our area.

Other sources of air pollution are industrial facilities which release air toxics. Please see Hazardous Waste section below for more information.

Table 3-1: Air quality status by year and location

Location	Air Quality	2018	2019	2020	2021
Benton: Corvallis	Good	340	332	330	363
	Moderate	23	33	25	2
	Unhealthy for Sensitive Groups	2	0	0	0
	Unhealthy	0	0	3	0
	Very unhealthy	0	0	5	0
	Hazardous	0	0	3	0
Linn: Sweet Home	Good	299	297	320	360
	Moderate	65	68	36	5
	Unhealthy for Sensitive Groups	1	0	1	0
	Unhealthy	0	0	1	0
	Very unhealthy	0	0	2	0
	Hazardous	0	0	6	0

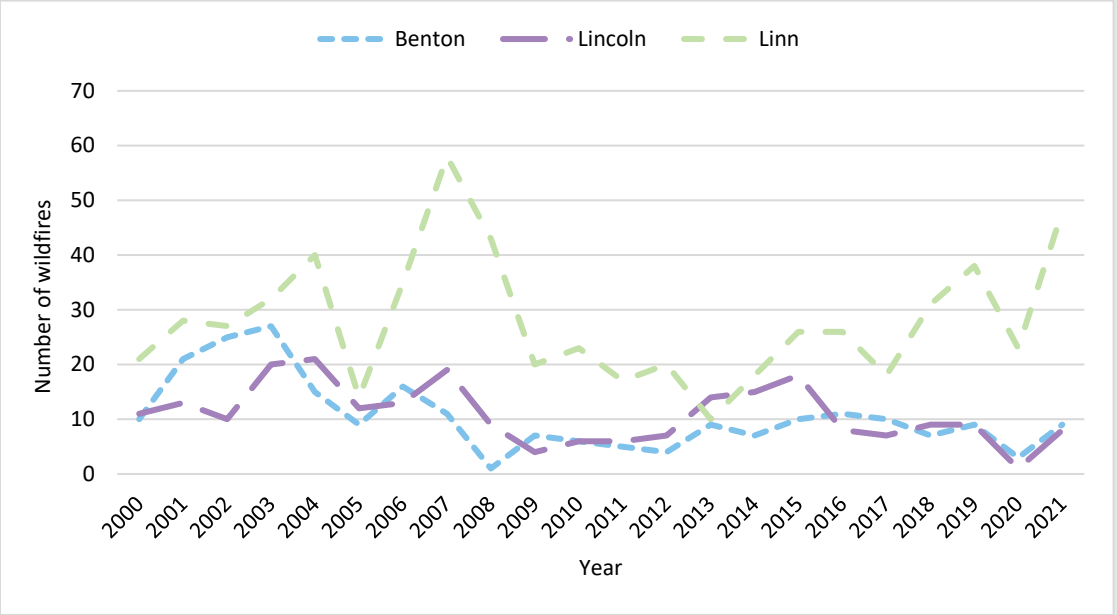
Note: Future updates will include new Lincoln County Toledo site data. 2020 was a leap year with 366 days.
Data source: Oregon Department of Environmental Quality air quality monitors
Time period: 2018-2021
For more information: https://www.oregon.gov/deq/aq/Pages/aqi.aspx, https://www.oregon.gov/deq/aq/Documents/2020AQMonitoringReport.pdf

Wildfires

Wildfires affect health in many ways other than air quality. People living near wildlands can be displaced by wildfires, lose their homes or other property, and experience mental and emotional distress. In the summer, winds often blow north to south along the Oregon Coast (Oregon Coastal Atlas), so we included Washington wildfire acres along with Oregon's below.

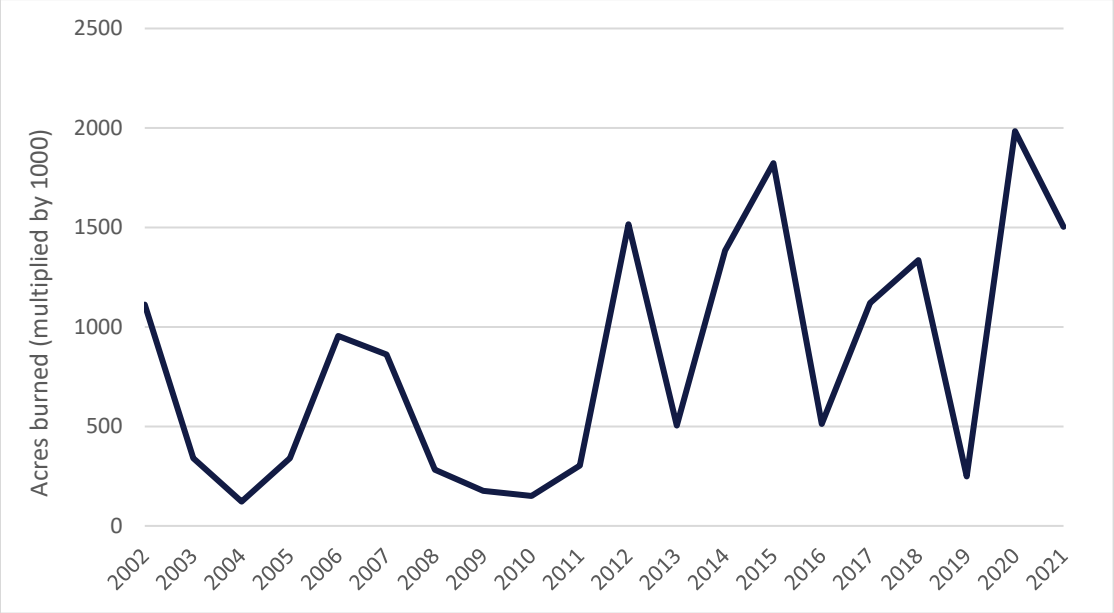
Fortunately, wildfires do not often kill many people in Oregon, but nine people died across the state of Oregon during the record-setting 2020 wildfire season. The 2020 Echo Mountain fire in Lincoln County displaced 532 families; 49 individuals were still being sheltered as of May 2022, and an additional 162 families continue to receive Disaster Case Management services.[12]

Figure 3-1: Number of wildfires by year and location



Data source: Oregon Department of Forestry
Time period: 2000-2021
For more information: https://oregon-department-of-forestry-geo.hub.arcgis.com/datasets/geo::odf-fire-2/about

Table 3-2: Total acres burned in thousands over time in Oregon and Washington



Data source: National Interagency Fire Center
Time period: 2002-2021
For more information: https://www.nifc.gov/fire-information/statistics

Heat

Extreme heat makes many populations, such as those with chronic disease, young children, older adults, and outdoor workers, vulnerable to heat-related illnesses such as heat stroke, fainting, heat exhaustion, and heat cramps. Wildfire smoke, air pollution, and pollen can make respiratory conditions such as asthma worse.[13]

Periods of extreme heat can exacerbate health conditions and cause deaths. The heat wave in June 2020 caused at least 96 deaths across the state of Oregon.[14] Climate change is increasing the likelihood and intensity of heat waves across the region, although the natural variability from year to year can obscure the trend over shorter time intervals.

Table 3-3: Number of high heat and extreme heat days by year and location of monitoring sites

Location	Heat Level	2017	2018	2019	2020	2021
Benton County (Hyslop Field Station)	High heat	57	47	29	43	58
	Extreme heat	12	10	3	8	11
Lincoln County (Otis)	High heat	11	2	5	4	4
	Extreme heat	4	0	0	0	0
Linn County (Marion Forks)	High heat	57	43	24	37	57
	Extreme heat	7	4	1	4	13

Note: high heat = daily maximum temperature above 84 degrees F; extreme heat = daily maximum temperature above 94 degrees F
Data source: National Oceanic and Atmospheric Administration
Time period: 2017-2021
For more information: https://www.climate.gov/maps-data/all

Marion Forks is located along Highway 22 in the eastern Linn County Cascade foothills. Hyslop Field Station is located along Highway 20 between Corvallis and Albany. Otis is located along Highway 18 in northwestern Lincoln County. Together, these three stations provide good coverage of the three different environments of the region (Cascades, Valley, and Coastal).

Water

Water quality and quantity are interdependent. Oregon is currently in the worst megadrought on record. Although there have been individual years of wet conditions over the past two decades, on average conditions have been drier than any other 22-year period in the past thousand years. Drought conditions impact water supplies, streamflow, agriculture productivity, wildfire danger, and ecosystem health.[15] For past, current and future drought conditions, please visit https://www.drought.gov/states/oregon.

Water quality is another factor that impacts health. Water quality varies greatly across geography, and even from source to source. The larger community drinking water systems in the three counties test regularly for many contaminants. Average water contaminant levels usually test below the EPA standards for the four listed contaminants in the three counties (Table 3-4). However, contaminant levels can vary widely, and there are no surveillance systems that monitor individual water sources such as private wells.

Arsenic is a known carcinogen, and there is no safe level of arsenic in drinking water. The EPA has set a standard of 10 µg/L in drinking water, but has a goal of 0 µg/L.

Nitrates can occur naturally in groundwater, but human sources such as fertilizer are the major source of high concentrations of nitrates. Nitrates can interfere with the blood's ability to carry oxygen, which can be a major risk for bottle-fed babies under six months old. The EPA standard for nitrates is 10 mg/L.

Haloacetic acids (HAA) and Trihalomethanes (TTHM) occur when chlorine used to disinfect water interacts with other naturally occurring chemicals in the water. There is some evidence that HAA5 (the 5 major compounds) and TTHMs can increase the risk of certain cancers or other diseases. The EPA regulatory standard is 60 µg/L in drinking water for HAA5 and 80 µg/L for TTHM.[16]

Table 3-4: Contaminants levels above federal standards in community public water systems, by contaminant and location

Contaminant & Regulatory Standard	Year	Benton	Lincoln	Linn
Arsenic (10 µg/L)	2020	0	0	0
	2019	0	0	0
	2018	0	0	0
Nitrate (10 mg/L)	2020	0	0	0
	2019	0	0	0
	2018	0	0	0
HAA5 (60 µg/L)	2020	0	0	0
	2019	0	0	0
	2018	0	0	0
TTHMs (80 µg/L)	2020	1	0	0
	2019	1	2	0
	2018	0	0	0

Note: Systems don't test every year.
Data source: Oregon Environmental Public Health Tracking
Time period: 2018-2020
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/CommunityWaterSystem_16680312416720/MapVisualization

Water fluoridation is a low cost and effective way of improving the oral health of populations. It protects every user of the water system against cavities, making it an important tool in improving health equity. Only 22% of Oregonians drink fluoridated water, compared to more than 50% of the total United States population. This is well below the Healthy People 2020 goal of 80%.

Table 3-5: Cities with fluoridated community public water systems by county

County	Cities
Benton	Adair Village, Corvallis, North Albany, and Philomath
Lincoln	No fluoridated public water systems in Lincoln County
Linn	Albany, Lebanon, and Sweet Home

Data source: Centers for Disease Control and Prevention (CDC)
Time period: website referenced January 2023
For more information: https://nccd.cdc.gov/DOH_MWF/Default/Default.aspx

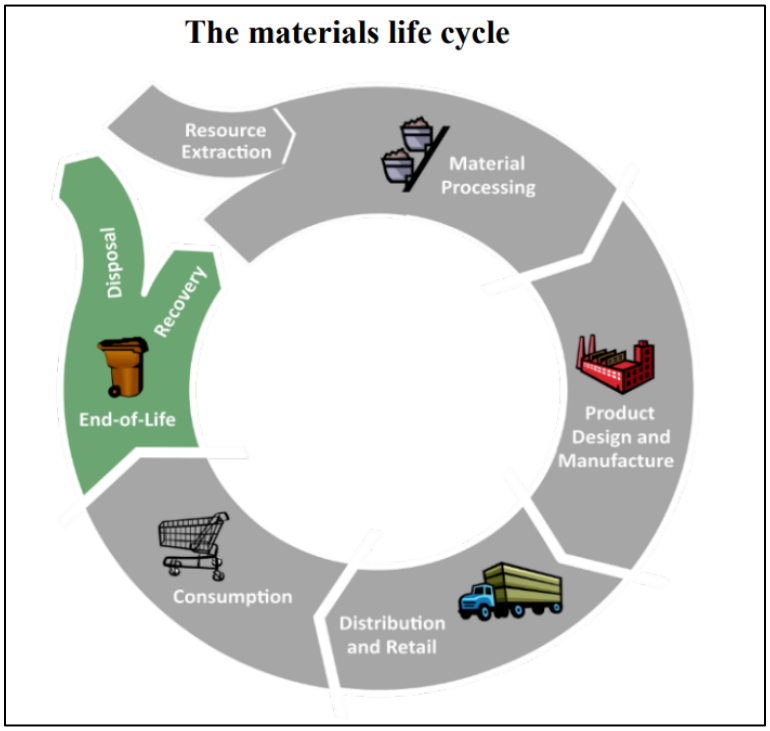
Solid Waste

Solid waste collection, recovery, disposal, and landfills are regulated to help protect our environment and public health. Reducing and recovering waste is important because each step in a product's life cycle takes raw materials, time, and energy (see the materials life cycle in Figure 3-2 below).

In Oregon we recover about 40% of the waste we generate, mostly through local recycling and composting efforts. Local manufacturers, governments and haulers are redesigning processes and systems. By 2024 we should see major headlines on improvements, thanks to Oregon's Recycling Modernization Act.[17]

Reducing food waste and plastic waste are two priorities due to their environmental impacts. Food production generates greenhouse gases, as does disposal in landfills. Plastic products break down in the environment into microplastics. These microplastics can end up in our food, water, air and lungs.[18] We can each do our part to reduce waste and pollution by buying less stuff, especially hazardous/toxic products. We can buy local products, look for packaging that is locally recyclable, and properly recycle and dispose of waste.

Figure 3-2: The materials life cycle



Source: Oregon Department of Environmental Quality
For more information: https://www.oregon.gov/deq/FilterDocs/2017mrwgrates.pdf

Hazardous Waste

Household and other hazardous wastes are collected and handled separately to protect environmental and public health. Household hazardous wastes include pesticides, herbicides, poisons, solvents, fuels, paints, motor oil, antifreeze, and mercury-containing wastes.

The Toxics Release Inventory (TRI)[19] includes certain toxic chemicals that may pose a threat to human health and the environment. Certain industrial facilities must report annually how much of each chemical is recycled, combusted for energy recovery, treated for destruction, and disposed of or otherwise released on- and off-site. In 2020, there were 287 of these facilities in Oregon including the following in the LBL region:

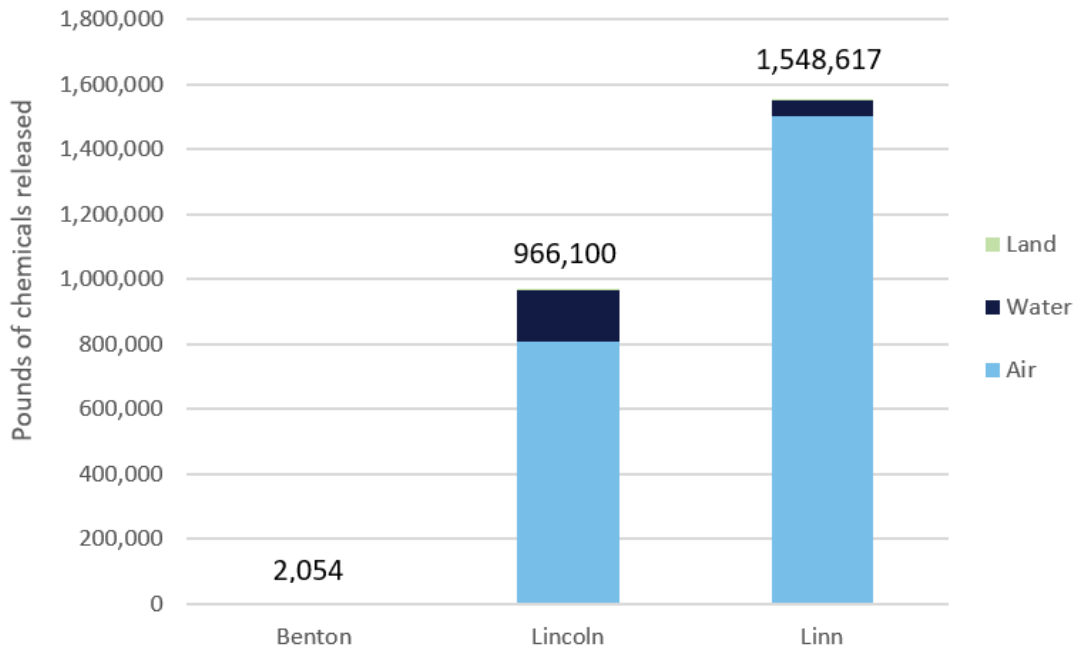
- One facility in Lincoln County that released on-site methanol, hydrogen sulfide, ammonia, nitrate compounds, acetaldehyde, and other chemicals.
- Four facilities in Benton County that released on-site barium compounds and zinc compounds.
- Seventeen facilities in Linn County that released on-site methanol, ammonia, nitrate compounds, manganese compounds, hydrochloric acid, acetaldehyde, and other chemicals.

Most of the facilities' on-site releases in Linn and Lincoln counties were to the air, consistent with Oregon. Benton County facilities released about 2,100 pounds on-site in 2020. This doesn't show up on the chart below because it's so much smaller than the approximately 966,000 pounds released on-site

by the facility in Lincoln County, and over 1.5 million pounds released on-site by facilities in Linn County, in 2020.

The Environmental Protection Agency and Oregon Department of Environmental Quality work with facilities on reducing waste and safer waste management by recycling, recovering energy from, and treating chemicals.[20, 21]

Figure 3-3: Pounds of chemicals released from industrial facilities in toxic release inventory



Data source: United States Environmental Protection Agency Toxic Release Inventory
Time period: 2020
For more information:
https://enviro.epa.gov/triexplorer/tri_factsheet.factsheet_forstate?pstate=OR&pyear=2020&pParent=TRI&pDataSet=TRIQ1

Neighborhood Environments

People need safe and healthy places to live, learn, work, play, and pray.[22] They need access to quality and affordable food, housing and transportation options, as well as the confidence that their local communities have not been contaminated with human-made pollutants.[23]

Populations including minoritized racial and ethnic groups, people experiencing poverty, people with disabilities, and people who experience language barriers are more likely to depend on public transit. However, they are more likely to live in areas with poor transit service, unsafe transportation conditions, fewer destinations, and poor connectivity. These burdens increase transportation costs and stress, and limit access to economic and educational opportunities, housing, healthy foods, and physical activity.

Transportation

Active transportation such as walking and biking increase physical activity, which has positive effects on overall health. Public transportation also involves active travel when walking or biking to and from stops or stations. 17.5% of Benton County's workforce used active transportation to and from work whereas 5.4% and 2.8% of Lincoln and Linn counties' workforce used active transportation respectively. There is a strong correlation between access to public transportation and using active transportation (which includes public transportation, cycling, and walking) to commute to work. Among Oregon counties with public transit systems, an increase of five percent of the population within one quarter mile of a bus station is associated with a one percent increase in the percent of the working population that commutes by active transportation.[24] This trend is reflected in regional statistics as well.

In comparison to Lincoln and Linn counties, Benton County community members have greater access to public transportation. This is due to the population concentration in Corvallis, which has the fareless Corvallis Transit System (CST). This provides a safe and reliable bus service to Corvallis community members. Benton County Dial-a-Bus provides transportation for seniors over 60 years of age and persons with disabilities who are unable to use public transit. Benton Area Transit provides the free 99 Express commuter bus services between Adair Village and Corvallis Monday through Friday.

Lincoln County's public transportation includes Lincoln City and Newport City Loops; north, south and east connecting routes; and Dial-a-Ride service.[25, 26] Linn County's public transportation includes Albany transit, which operates three fixed routes within the city of Albany; Linn-Benton Loop, which connects Albany and Corvallis; and Linn Shuttle, which provides public transportation service to East Linn County residents. There are additional transportation services available in Linn County by request or prior reservation.

The Coast to Valley Express is a regional bus service provided through a partnership between Benton Area Transit and Lincoln County Transit. This service provides four roundtrips everyday between Albany, Corvallis, and Newport.

Cascades West RideLine provides transportation services for eligible Oregon Health Plan (OHP) or Medicaid clients traveling to and from covered non-emergency medical services. Transportation is provided to those OHP eligible clients living in Linn, Benton, and Lincoln counties who have no other way to get to their medical Services.

Table 3-6: Percent of workforce 16 years and older by means of transportation to work and location

Transportation Type	Benton	Lincoln	Linn
Carpooled	7.4%	11.7%	10.2%
Drove alone	64.5%	73.0%	79.7%
Public transportation (excluding taxicab)	2.2%	0.6%	0.1%
Walked	7.9%	4.4%	1.9%
Biked	7.4%	0.4%	0.6%
Worked from home	9.4%	8.8%	6.2%

Data source: National Environmental Public Health Tracking Network
Time period: 2016-2020
For more information: https://ephtracking.cdc.gov/

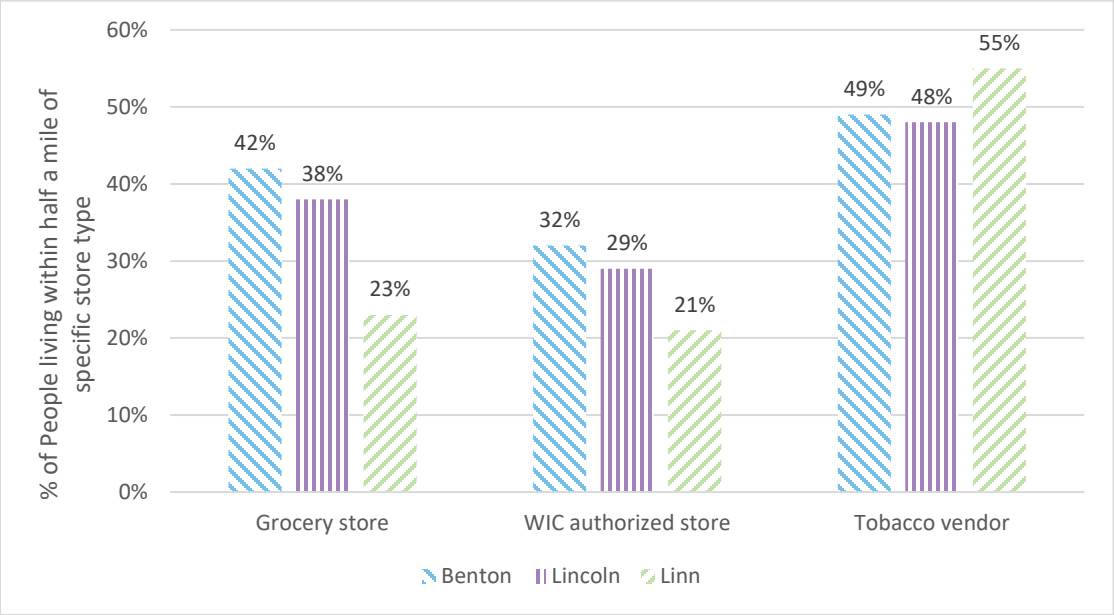
Food Access

Transportation options and limited public transportation for residents contributes to challenges in the region with regard to nutritious food access. For households without private vehicles, the ability to shop for food at grocery stores is highly dependent on proximity.

In all three counties, people are more likely to live within a half mile of a tobacco vendor than of a grocery store (Figure 3-4). Benton County community members have the greatest access to grocery stores as measured by proximity. This is due in part to the concentration of Benton County's population in one city (Corvallis), which has many grocery stores. In comparison, Linn and Lincoln counties' populations are more spread out among smaller communities, not all of which have full grocery stores with access to affordable and nutritious food.

All three counties belonging to the LBL region have farmers markets, which provide access to locally grown, nutritious foods. Benton County farmers markets include locations in Corvallis, Philomath, and North Albany. Lincoln County farmers markets include locations in Lincoln City, Newport, Toledo, Waldport, Yachats, and Siletz. Linn County has farmers markets in Albany, Lebanon, Brownsville, and Sweet Home. While these markets provide increased access to fresh and nutritious food, most only operate a single day a week during the spring and summer months. The outdoor Corvallis Market is open two days per week and operates an indoor market during the winter months.

Figure 3-4: Percent of people who live within half a mile of specific store types by location



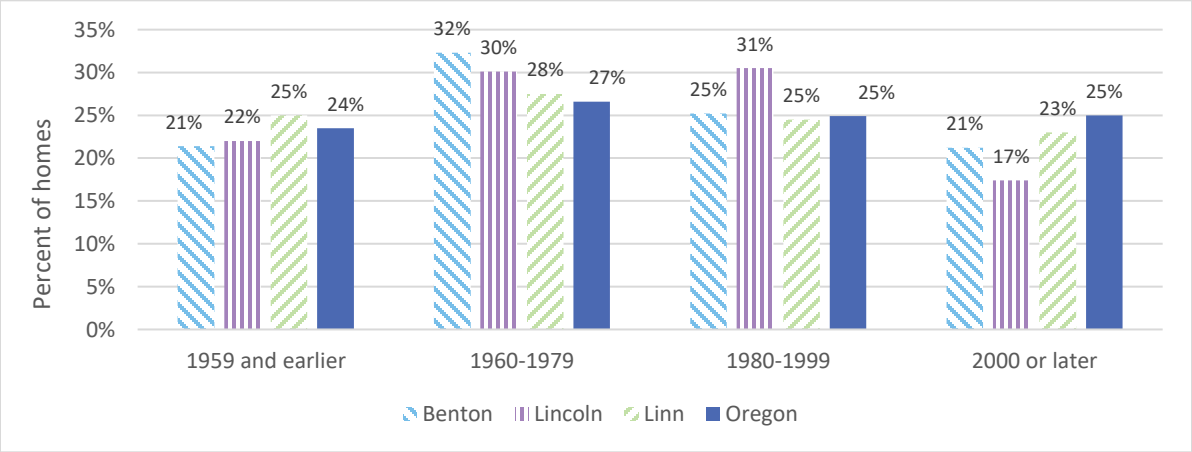
Data source: Oregon Public Health Assessment Tool
Time period: 2019
For more information: Contact Benton County Health Department

Housing

The age of a house can predict many other factors that affect the health of the occupants, including exposure to lead, asbestos, or other hazardous materials, mold or pest infestations, and weather resistance and temperature stability.

For additional housing data, see Chapter 4: Social Determinants of Health.

Figure 3-5: Percent of homes built by year and location



Data source: United States Census Bureau, America Community Survey, Table B25034
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Parks and Recreation

Research demonstrates a strong relationship between access to green outdoor spaces and physical activity and mental health and wellbeing among adults and children. Studies have shown that proximity to places with recreational opportunities is associated with higher physical activity and lower obesity levels.[27] Public recreation areas include parks, schools, public forests and trails, beaches, and waterfronts.

Publicly owned land is land managed by either federal, state, or local governments and is protected for natural resources, open spaces, and recreational areas. In 2019, 39.7% of Linn County's land was publicly held, 29.2% of Lincoln County's land was publicly held, and 26.4% of Benton County's land was publicly held.[28]

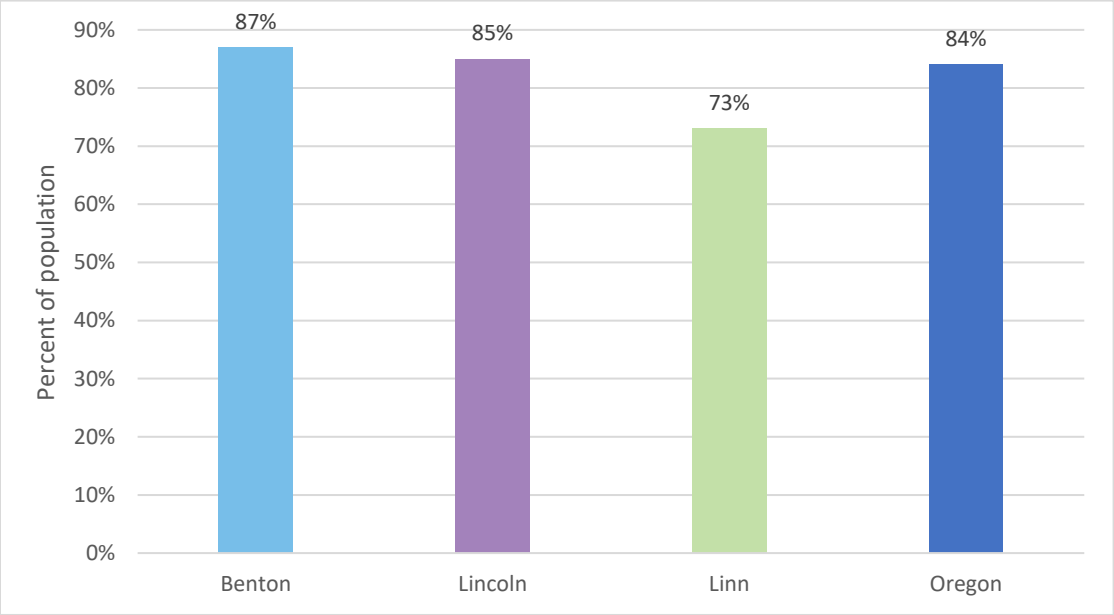
Both Benton and Lincoln counties have greater access to exercise opportunities than does the state of Oregon (Figure 3-6). Access to exercise opportunities is measured as census blocks where the border is a half mile or less from a park or 1 mile or less from a recreational facility in urban census blocks and 3 miles or less in rural census blocks.

Benton County has a plethora of outdoor recreational opportunities available county residents and visitors. The City of Corvallis Parks and Recreation Department manages 2,000 acres of parks, playgrounds, playing fields, trails, open spaces and beautification areas. Overall, there are 20 miles of trails in city natural areas and parks. The department has set a standard of 0.54 miles of trail per 100,000 people; it currently has 0.36 miles per 100,000 people, a deficit of 10 miles of trail. Benton County Natural Areas, Parks & Events (NAPE) works with private landowners, City of Corvallis Parks and Recreation, City of Philomath, Siuslaw National Forest, Oregon State University (OSU) Research Forests, Greenbelt Landtrust, Crestmont Landtrust, and others to offer a trail system that provides health and recreation benefits to the community. NAPE also manages over 1,400 acres of natural areas, open spaces, and parks, including forests, wetlands, boat landings, historic sites, and a campground.

Lincoln County has many public beaches and parks that provide free and low-cost places for the county's residents and many tourists to gather, hike, camp, fish, and more. The Lincoln County Parks department maintains 13 parks, which include campgrounds and waysides. Lincoln County's three recreation centers help advance community health and wellbeing through safe and accessible services, programs, and facilities for children, seniors, and families. Lincoln County benefits from the status of Oregon beaches, which are considered public parks and are open to all.

Linn County is home to 30 parks dotted throughout the heart of the Willamette Valley. Activities in these parks include camping, hiking, swimming, fishing and more. The non-profit organization Build Lebanon Trails is expanding trail access within the county, with the goal of building more than 50 miles of trail systems in the town of Lebanon.

Figure 3-6: Percent of population with access to exercise opportunities* by location



**Access to exercise opportunities is measured as census blocks where the border is a half mile or less from a park or 1 mile or less from a recreational facility in urban census blocks and 3 miles or less in rural census blocks.*

Data source: County Health Rankings

Time period: 2022

For more information: https://www.countyhealthrankings.org/explore-health-rankings/county-health-rankings-model/health-factors/health-behaviors/diet-and-exercise/access-to-exercise-opportunities

4 Social Determinants of Health

Social determinants of health (SDOH) are the non-medical factors found in an individual's environment that predict health outcomes and influence health inequities. The World Health Organization defines the social determinants of health as the "conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life."[29] When conducting and implementing public health work, it is essential that programs and policies prioritize improving the root causes of poor health. Without properly addressing these upstream factors, interventions will be unsuccessful at improving population health outcomes and reducing inequities. Chapter 2: Who We Are and Chapter 3: Environmental Health already introduced information on neighborhood and built environment as well as social and community context. In this chapter, additional data will be presented for three domains of social determinants of health: economic stability, education access and quality, and neighborhood and built environment in the context of Benton, Linn, and Lincoln counties. The other two domains, health care access and social and community context, will be addressed in other chapters.

Figure 4-1: Centers for Disease Control and Prevention (CDC) graphic on social determinants of health

For more information: https://www.cdc.gov/publichealthgateway/sdoh/index.html

Economic Stability

Financial stability impacts multiple facets of an individual's health and behaviors. Access to a high steady income allows people to purchase healthy foods and services, live in safe neighborhoods with better schools, and have greater access to healthcare resources. The overall median household income for Oregon between 2016-2020 was $65,667; the median household income for Benton, Lincoln, and Linn counties during the same time period was $65,142, $50,775, and $59,547 respectively.[30]

Despite Benton County having a high median household income, the income inequality ratio for the county was the largest in the state of Oregon in years 2016-2020. The larger the income inequality ratio, the more unevenly income is distributed within a population. This is associated with loss of social connectedness, and decreases in trust and sense of community, which can have broad health impacts including increased risk of mortality.[31] The ratio of income at the 80th percentile to income at the 20th percentile in Benton County was 5.5, compared to 4.5 for the state of Oregon overall. This means that households with higher incomes had incomes 5.5 times that of households with lower incomes. Benton County's high income inequality is partly driven by both high-salary positions among major employers (Oregon State University, Samaritan Health Services, Hewlett Packard) as well as the large number of students with relatively low incomes. From 2016-2020, over half of 18-24 year old's in Benton County were living in poverty (Table 4-2).

In Oregon, residents identifying as White were less likely to live in poverty. With a few exceptions, this trend is seen in the LBL region as well (Table 4-3). Disability status is also associated with poverty. Approximately 20% of those living with a disability in Linn, Benton, and Lincoln counties were living in poverty in 2016-2020 (Figure 4-2). This is consistent with the state of Oregon as a whole.

Table 4-1: Income inequality by location

Income Variable	Benton	Lincoln	Linn	Oregon
80th percentile of total income range	$132,226	$92,921	$104,041	$126,927
20th percentile of total income range	$23,937	$21,890	$26,925	$28,050
Income inequality ratio	5.5	4.2	3.9	4.5

Data source: County Health Rankings
Time period: 2016-2020
For more information: https://www.countyhealthrankings.org/explore-health-rankings

Table 4-2: Percent of age categories living in poverty by location

Age Category	Benton	Lincoln	Linn	Oregon
Under 5 years	14.5%	31.2%	15.5%	16.5%
5 to 11 years	13.6%	23.2%	15.5%	15.2%
12 to 17 years	16.3%	22.1%	11.4%	13.6%
18 to 24 years	51.6%	18.4%	20.1%	24.1%
25 to 34 years	20.3%	17.2%	14.0%	13.2%
35 to 44 years	11.2%	17.2%	11.4%	10.1%
45 to 54 years	7.3%	17.0%	10.6%	9.3%
55 to 64 years	7.4%	17.8%	11.6%	11.0%
65 to 74 years	4.7%	7.2%	7.3%	7.8%
75 years and over	5.9%	7.0%	7.7%	8.5%

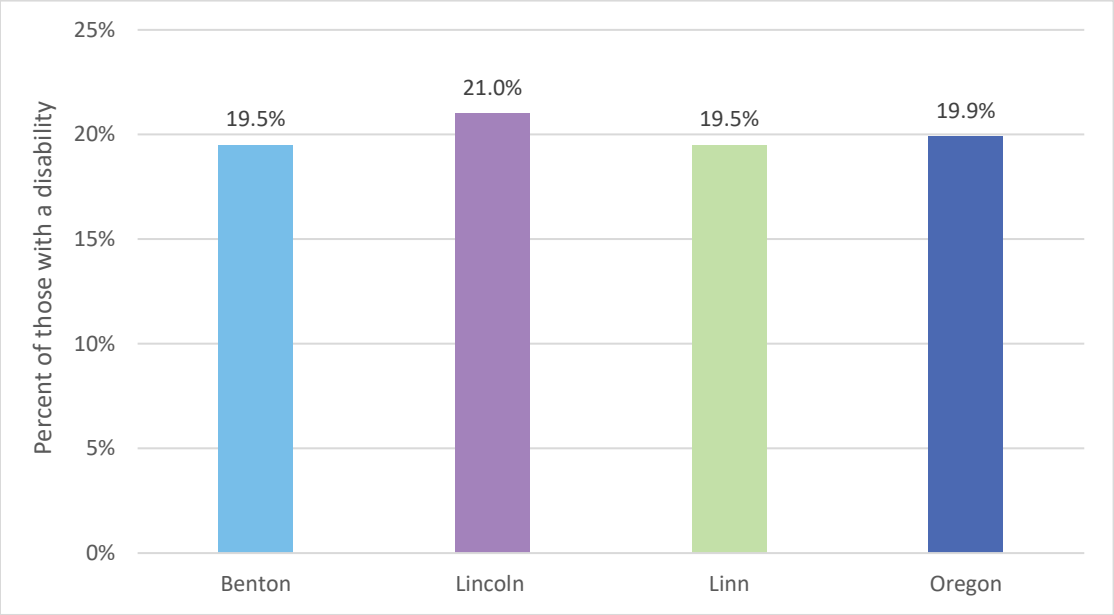
Data source: United States Census Bureau, America Community Survey, Table B17001
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 4-3: Percent of racial/ethnic groups below poverty level by location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	19.9%	26.7%	12.6%	22.1%
Asian	41.2%	40.6%	13.1%	13.1%
Black or African American	44.9%	26.6%	2.2%	27.4%
Hispanic or Latino	22.6%	19.0%	15.4%	17.8%
Native Hawaiian or Pacific Islander	16.0%	5.6%	10.3%	17.1%
Some other race	30.8%	5.4%	18.0%	16.5%
Two or more races	19.1%	20.9%	14.6%	15.3%
White	15.9%	15.1%	11.9%	11.5%

Data source: United States Census Bureau, America Community Survey, Table S1701
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Figure 4-2: Percent of those with a disability living in poverty by location



Data source: United States Census Bureau, America Community Survey, Table C18130
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 4-4: Median household income by race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	$49,167	*	$42,236	$48,225
Asian	$41,667	$50,337	$90,787	$83,125
Black or African American	*	$23,125	$58,462	$44,138
Hispanic or Latino	$54,375	$58,695	$45,281	$54,797
Native Hawaiian or Pacific Islander	$155,714	*	*	$69,547
Some other race	$36,974	$61,640	$45,058	$55,422
Two or more races	$73,684	$40,540	$58,679	$57,283
White	$67,298	$50,213	$59,841	$66,480

**Unreliable due to small numbers*
Data source: United States Census Bureau, America Community Survey, Table B19013A – B19013I
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Education

The LBL region has a diverse distribution of academic resources that result in differences in the educational profiles of the three counties. Benton County, home to Oregon State University (OSU), has a unique social and population demographic as the city of Corvallis is centered about the university. OSU is one of three land, sea, space, and sun grant universities in the United States and offers nearly 200 degree programs. The residents of Benton County are highly educated, with a high proportion of the population having received at least a bachelor's degree (Table 4-5). Both Linn and Lincoln counties have community colleges, however the populations are much less centralized around an academic institution. Oregon Coast Community College, located in Lincoln County, offers associate degree and certificate programs in aquarium science, nursing and allied health, accounting, and welding. Lincoln County is also home to Oregon State University's Hatfield Marine Science Center, a world-class marine laboratory located in Newport. Linn County is home to Linn-Benton Community College's (LBCC) main campus and the campus for Western University of Health Sciences Oregon (WesternU Oregon). LBCC is one of the largest community colleges in Oregon and offers seven meta majors. WesternU Oregon offers three graduate programs in the medical field. The majority of Linn and Lincoln County residents have at attended at least some college or received an associate degree (Table 4-5).

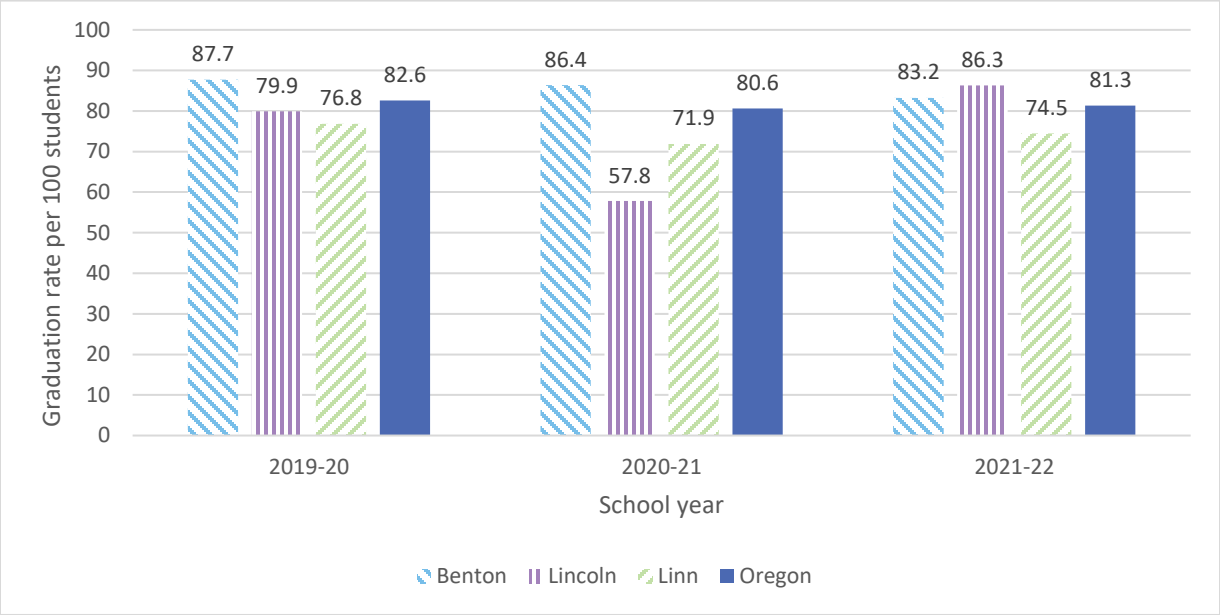
On average for years 2019-2022, Linn and Lincoln counties had similar high school graduation rates. Lincoln County's high school graduation rate during the 2020/2021 school year fell far below the Oregon state average, but by the following school year, its graduation rate exceeded that of Oregon. Benton County had a consistently high graduation rate, exceeding the state average for all three school years shown in Figure 4-3.

Table 4-5: Highest educational level achieved among adults age 25 years and over by location

Educational Level	Benton	Lincoln	Linn	Oregon
Less than high school	3.8%	7.7%	10.1%	8.9%
High school graduate	13.7%	24.9%	29.2%	22.7%
Some college or associate degree	29.2%	39.6%	41.1%	34.1%
Bachelor's degree	29.2%	17.2%	12.9%	21.3%
Graduate or professional degree	24.0%	10.5%	6.6%	13.1%

Data source: United States Census Bureau, America Community Survey, Table S1501
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Figure 4-3: High School graduation rate per 100 students by school year and location



Data source: Oregon Department of Education, Cohort Graduation Rate
Time period: school year 2020-2021
For more information: https://www.oregon.gov/ode/reports-and-data/students/Pages/Cohort-Graduation-Rate.aspx

Table 4-6: Percent of high school students that graduate on time by race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	*	80%	65.8%	68.9%
Asian	>95%	*	83.3%	92.1%
Black or African American	*	*	63.2%	73.7%
Hispanic or Latino	81.0%	82.6%	76.5%	78.7%
Native Hawaiian or Pacific Islander	*	*	*	74.6%
Multi-Racial	86.8%	92.7%	71.2%	79.7%
White	82.9%	87.9%	74.6%	82.5%

**Unreliable due to small numbers*
Data source: Oregon Department of Education, Cohort Graduation Rate
Time period: 2021-2022
For more information: https://www.oregon.gov/ode/reports-and-data/students/Pages/Cohort-Graduation-Rate.aspx

Food Insecurity

Access to healthy affordable food is an important predictor of health status. As the environmental effects of climate change become more severe in the future, public health practitioners are increasingly worried about production, higher prices, and obstacles in the global distribution of food. In the United States there are two primary federally funded health and nutrition programs. The Women, Infants, and Children Program (WIC) is a supplemental nutritional program that provides healthy foods to pregnant, breastfeeding gestational parents, infants, and children to promote optimal childhood development.[32] The Supplemental Nutrition Assistant Program (SNAP) provides access to healthy food for low-income families.[33] Linn and Lincoln counties had higher utilization of SNAP and WIC benefits compared to Benton County in 2020. Only about 10% of households in Benton County received SNAP benefits compared to 20.6% of households in Lincoln County and 18.6% of households in Linn County. Families with children under the age of 18 and/or with a disabled family member commonly utilize SNAP benefits across the LBL region (Table 4-9).

Food insecurity is a lack of consistent access to enough food for every person in a household to live an active, healthy life.[34] Estimates of food insecurity in the three counties making up the LBL region have remained fairly consistent from years 2018-2020. Based on these estimates, Lincoln County experienced the greatest food insecurity in the LBL region, followed by Linn County. All three counties have access to emergency food support thanks to community-based organizations operating in the LBL region.

Table 4-7: Use of WIC benefits by location

WIC Variables	Benton	Lincoln	Linn	Oregon
WIC participants	1,541	1,493	4,160	110,890
Families served by WIC	875	856	2,241	64,450
Percent of all pregnant women served by WIC	24%	41%	30%	27%

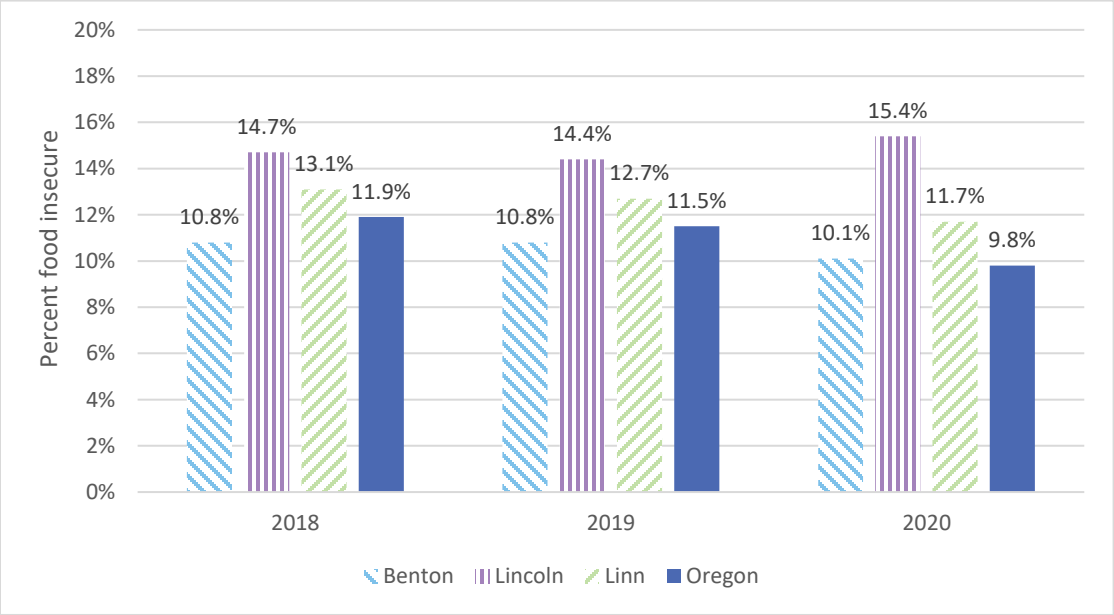
Data source: Oregon Health Authority, WIC Data Sheets
Time period: 2021
For more information: https://www.oregon.gov/oha/PH/HEALTHYPEOPLEFAMILIES/WIC/Pages/annual.aspx

Table 4-8: Use of SNAP benefits by location

SNAP Variables	Benton	Lincoln	Linn	Oregon
Percent of all households that use SNAP benefits	10.1%	20.6%	18.6%	15.0%
Percent of households with children under the age of 18 that use SNAP benefits	37.5%	29.5%	43.7%	40.8%
Percent of households with one or more people with a disability that use SNAP benefits	48.9%	58.5%	53.0%	49.9%

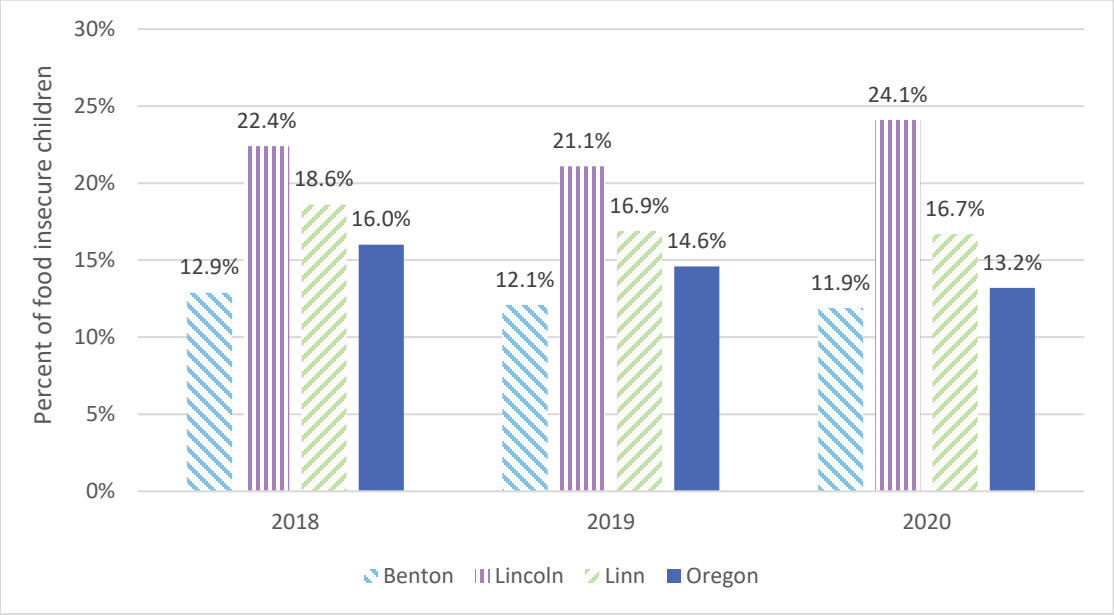
Data Source: United States Census Bureau, America Community Survey, Table S2201
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Figure 4-4: Estimated percent of population experiencing food insecurity by year and location



Data source: Feeding America, Map the Meal Gap
Time period: 2018-2020
For more information: https://map.feedingamerica.org/

Figure 4-5: Estimated percent of children under age 18 experiencing food insecurity by year and location



Data source: Feeding America, Map the Meal Gap
Time period: 2018-2020
For more information: https://map.feedingamerica.org/

Emergency Food Support

The Linn Benton Food Share operates five meal sites in Linn County and three meal sites in Benton County. They also operate 11 food pantries in Linn County and nine food pantries in Benton County where emergency food boxes are provided to anyone at or below 300% of the federal poverty level. During the 2020-2021 fiscal year, the Linn Benton Food Share distributed 4.4 million pounds of food and provided 330,537 emergency meals to the Linn and Benton County communities.[35]

Food Share of Lincoln County provides similar resources to the Lincoln County community. Food Share of Lincoln County operates four hot meal sites and eight food pantries across Lincoln County. In 2021, Food Share's network of agencies distributed 894,697 pounds of food (equating 3,578,788 meals). This same year, 33,870 individuals representing approximately 14,143 families received emergency and/or supplemental food from Food Share of Lincoln County.[36]

Housing

Access to safe, quality, and affordable housing is a core necessity for healthy living. Lincoln County had the highest percentage of home ownership in the LBL region, closely followed by Linn County. Despite 66% of homes being occupied by the owner, Lincoln County homeowners spent a large percent of their income on housing costs, including mortgage, insurance, and utilities. Renters in Benton County spent the largest proportion of household income on rent, with 54.1% of households spending more than 30% and 32.7% of households spending more than 50% of their total income on rent. Comparatively, homeowners in Benton County were the least burdened by housing costs in the LBL region (Figure 4-6 and 4-7).

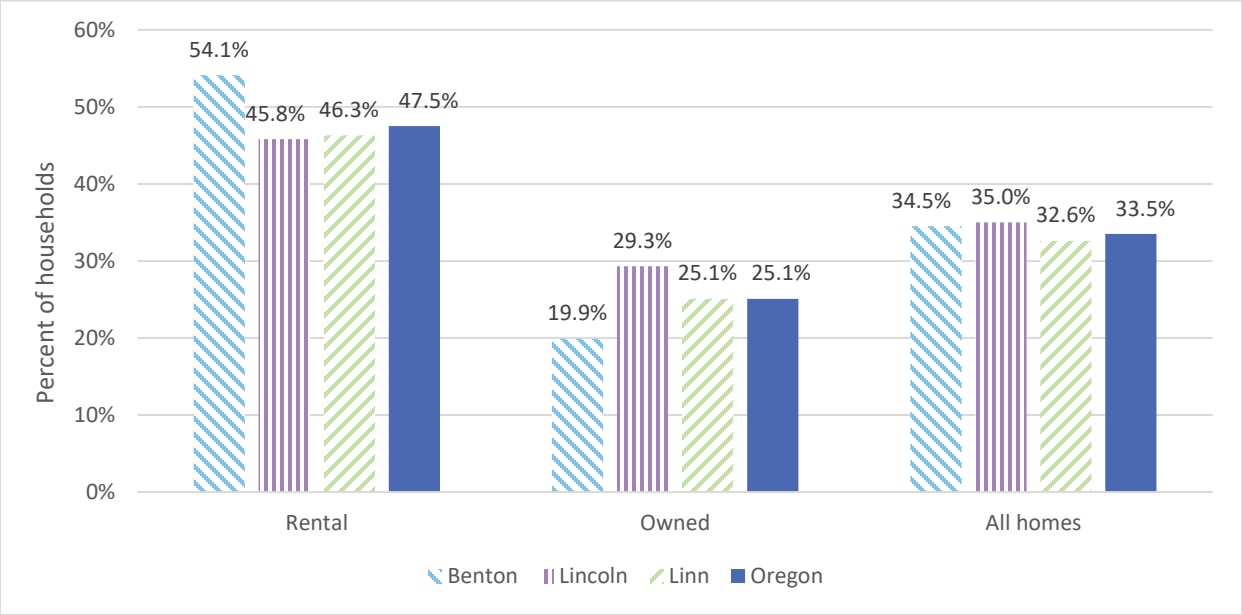
Across the LBL region, between 31% and 42% of unhoused persons had a disabling condition and experienced homelessness for a year or more, defined as chronic homelessness (Table 4-11). Chronic homelessness is especially high amongst veterans in the LBL region. In Oregon, coastal communities have large concentrations of children living on their own and experiencing homelessness.[37] This is consistent with regional findings, which show that Lincoln County had a disproportionately high percentage of K-12 students experiencing homelessness during the 2019-2020 school year (Figure 4-8).

Table 4-9: Percent of population by home ownership status and location

Ownership Status	Benton	Lincoln	Linn	Oregon
Owner occupied	56.8%	69.0%	66.4%	62.8%
Renter occupied	43.2%	31.0%	33.6%	37.2%

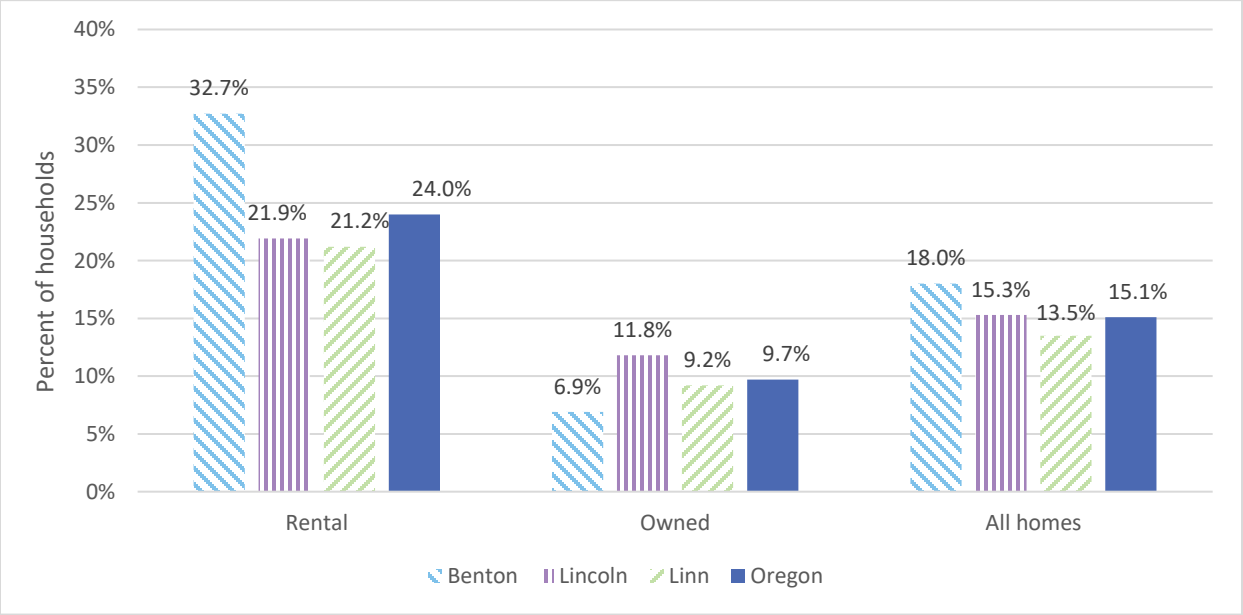
Data source: United States Census Bureau, America Community Survey, Table DP04
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Figure 4-6: Percent of households experiencing housing burden by ownership status and location



Note: Housing burden is defined as paying more than 30% of household income on rent, mortgage, and utilities.
Data Source: United States Census Bureau, America Community Survey, Tables B2507s & B25091
Time period: 2020
For more information: https://data.census.gov/cedsci/

Figure 4-7: Percent of households experiencing extreme housing burden by ownership status and location



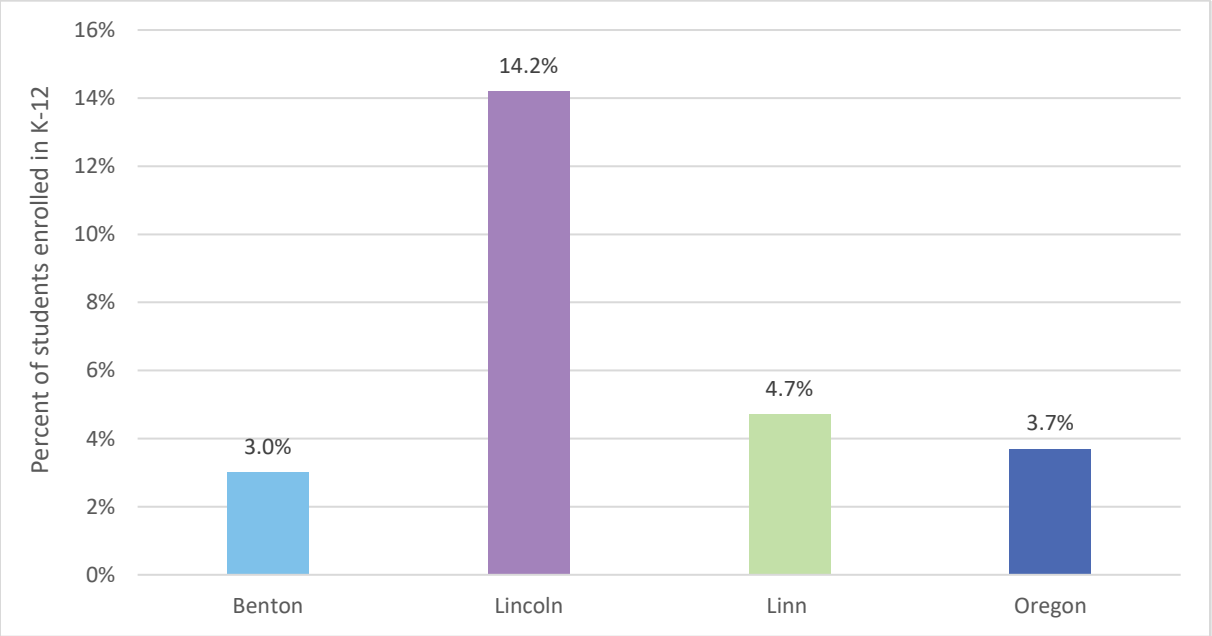
Note: Extreme housing burden is defined as paying more than 50% of household income on rent, mortgage, and utilities.
Data source: United States Census Bureau, America Community Survey, Table B25070, B25091
Time period: 2020
For more information: https://data.census.gov/cedsci/

Table 4-10: Demographics of the populations experiencing chronic homelessness by location

Demographic	Benton	Lincoln	Linn	Oregon
Percent of unhoused persons experiencing chronic homelessness	31%	35%	42%	31%
Percent of Veterans who experience chronic homelessness	65%	67%	52%	43%

Note: Chronic homelessness is used to describe people who have experienced homelessness for at least a year — or repeatedly — while struggling with a disabling condition such as a serious mental illness, substance use disorder, or physical disability.
Data source: Point-in-Time Homeless Count
Time period: 2019
For more information:
https://public.tableau.com/app/profile/oregon.housing.and.community.services/viz/2019Point-in-TimeDashboard/Story1

Figure 4-8: Percent of students enrolled in K-12 experiencing homelessness



Data source: Oregon Department of Education, K-12 District Totals and Percent of Enrollment
Time period: 2019-2020
For more information: https://www.oregon.gov/ode/schools-and-districts/grants/esea/mckinney-vento/pages/default.aspx

Table 4-11: Percent of the homeless population by race and location

Race	Benton	Lincoln	Linn	Oregon
Asian	1%	0%	0%	4%
Black / African American	3%	1%	3%	2%
Native American	4%	7%	2%	1%
Native Hawaiian / Pacific Islander	1%	0%	1%	0.4%
Two or more races	7%	7%	6%	5%
White	83%	85%	85%	85%

Data source: Point-in-Time Homeless Count
Time period: 2019
For more information:
https://public.tableau.com/app/profile/oregon.housing.and.community.services/viz/2019Point-in-TimeDashboard/Story1

5 Access to Health Services

Being able to access high-quality health care when needed is important for everyone. However, access to affordable quality healthcare remains a systemic issue across the country. Gaps in care access have been attributed to costs, rurality, provider shortages, and a lack of trust in the medical community.

In the LBL region, Samaritan Health Services is the largest provider of healthcare services. Samaritan operates five hospitals (two acute care hospitals, in Corvallis and Albany, and three critical access hospitals, in Lebanon, Lincoln City, and Newport) and 80 outpatient clinics spread throughout Benton, Lincoln and Linn counties. The Community Health Centers of Benton & Linn Counties operate four Federally Qualified Health Centers (Alsea, Corvallis, Lebanon, and Sweet Home) and two school-based health clinics (Corvallis and Monroe) throughout the region. The Lincoln Community Health Center operates three Federally Qualified Health Centers (Newport, Lincoln City, and Waldport) and four school-based health clinics (Newport, Taft, Toledo, and Waldport).

The healthcare industry in the United States is undergoing substantial changes. Emerging issues related to access to health services include the rise of telemedicine; policy changes related to abortion; and gender-affirming care for transgender individuals.

Telemedicine presents the opportunity to provide convenient cost-effective care to all populations, minimizing existing barriers to accessible healthcare. Since the start of the COVID-19 pandemic, the occurrence of telemedicine encounters has drastically increased. However, recent studies have documented inequalities in telemedicine utilization based on race and ethnicity, household income, and age.[38] Future usage of telemedicine will require direct attention towards this issue to prevent worsening disparities from occurring.

On June 24, 2022, the United States Supreme Court announced its decision to overturn Roe v. Wade severely limiting abortion access in the United States. Shortly after the announcement, Oregon leadership declared that they would be participating in a pact with Washington and California to protect abortion and contraceptive access. In 2020, Oregon providers performed approximately 7,000 elective abortions, of which 4% were performed for gestational parents residing in the LBL region.[39] As abortion access in other regions of the country becomes severely limited, it is expected that there will be an increased demand among out of state residents seeking abortion care in Oregon. Subsequently, availability of reproductive services will need to increase to continually provide timely access to care for all gestational people seeking treatment.

Identification as transgender or gender nonconformity has become increasingly prevalent in younger generations. In Oregon, 1.2% of adolescents between 13 and 17 years of age identify as transgender. In comparison, only 0.6% of adults identified as transgender. In the United States, an estimated 1.6 million people identify as transgender with over a quarter of the transgender population residing in the Western region of the country.[40] Literature has shown an extensive history of health disparities and barriers to care among transgender populations. As transgender youth grow and become more active healthcare consumers it is essential that adequate infrastructure is established to readily provide necessary care.

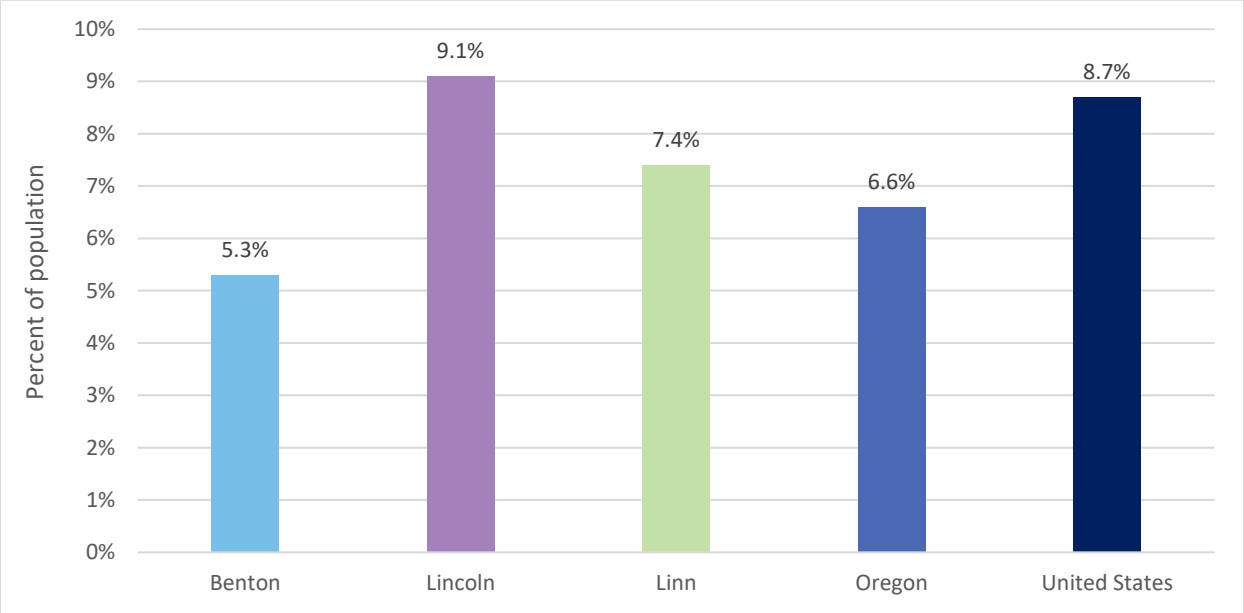
Locally, an issue related to access to care is increasing the primary care provider workforce. Samaritan Health Services created a new residency track for rural health (based in Newport) in 2022 as part of the

ACGME-accredited family medicine residency program based in Corvallis. This track offers two positions each year to enter the three-year program.

Insurance Coverage

Health insurance helps to guarantee a person can afford medical care in case of an emergency or when seeking preventative medicine. Between the three major types of health insurance (private insurance providers, Medicaid, and Medicare), 90% of the population residing in the LBL region has health insurance (Figure 5-1). LBL residents between the ages of 26 and 34 years of age had the lowest rates of insurance coverage (Table 5-1). This gap in coverage can be partially attributed to a stipulation in the Affordable Care Act (ACA), which only requires insurance providers to cover dependents until the age of 26. In the LBL region, Native Hawaiian/Pacific Islanders had the highest rates of insurance coverage (Table 5-2). Although insurance helps to reduce the financial burden of healthcare, the out-of-pocket cost of medical services is still a common issue reported by Americans.

Figure 5-1*:* Percent of the population without health insurance by location



Data source: United States Census Bureau, America Community Survey, Table S2701
Time period: 2016-2020
For more information: https://data.census.gov/all

Table 5-1: Percent of the population with health insurance coverage by age group and location

Age	Benton	Lincoln	Linn	Oregon
Under 6 years	98.4%	95.7%	91.5%	97.2%
6 to 18 years	95.9%	95.8%	93.3%	96.2%
19 to 25 years	93.2%	80.4%	87.6%	89.3%
26 to 34 years	88.7%	78.3%	87.8%	87.8%
35 to 44 years	93.0%	81.0%	88.9%	89.9%
45 to 54 years	93.1%	83.5%	93.3%	91.6%
55 to 64 years	96.0%	91.6%	93.1%	93.4%
65 to 74 years	99.3%	99.4%	99.1%	99.3%
75 years and older	100.0%	100.0%	99.5%	99.6%

Data source: United States Census Bureau, America Community Survey, Table S2701
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 5-2: Percent of the population with health insurance coverage by race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native alone	64.1%	87.2%	93.9%	87.7%
Asian alone	92.8%	87.2%	96.8%	94.9%
Black or African American alone	83.9%	89.9%	100.0%	93.0%
Hispanic or Latino ethnicity (of any race)	84.9%	81.2%	86.3%	84.9%
Native Hawaiian or Pacific Islander alone	100.0%	100.0%	100.0%	88.9%
Some other race alone	78.6%	84.1%	85.5%	83.2%
Two or more races	94.4%	94.4%	92.2%	91.9%
White alone	95.6%	91.0%	92.8%	93.9%

Data source: United States Census Bureau, America Community Survey, Table S2701
Time period: 2016-2020
For more information: https://data.census.gov/cedsci/

Table 5-3: Percent of the population with health insurance coverage by income level and location

Income	Benton	Lincoln	Linn	Oregon
Under $25,000	89.6%	90.4%	89.3%	91.0%
$25,000 to $49,999	93.5%	91.8%	89.3%	90.2%
$50,000 to $74,999	95.0%	87.6%	90.8%	91.5%
$75,000 to $99,999	92.7%	88.5%	95.6%	93.8%
$100,000 or more	97.2%	94.7%	96.5%	96.3%

Data source: United States Census Bureau, America Community Survey, Table B27015
Time period: 2016-2020
For more information: https://data.census.gov/table?q=B27015&g=0500000US41003,41041,41043

Provider Availability

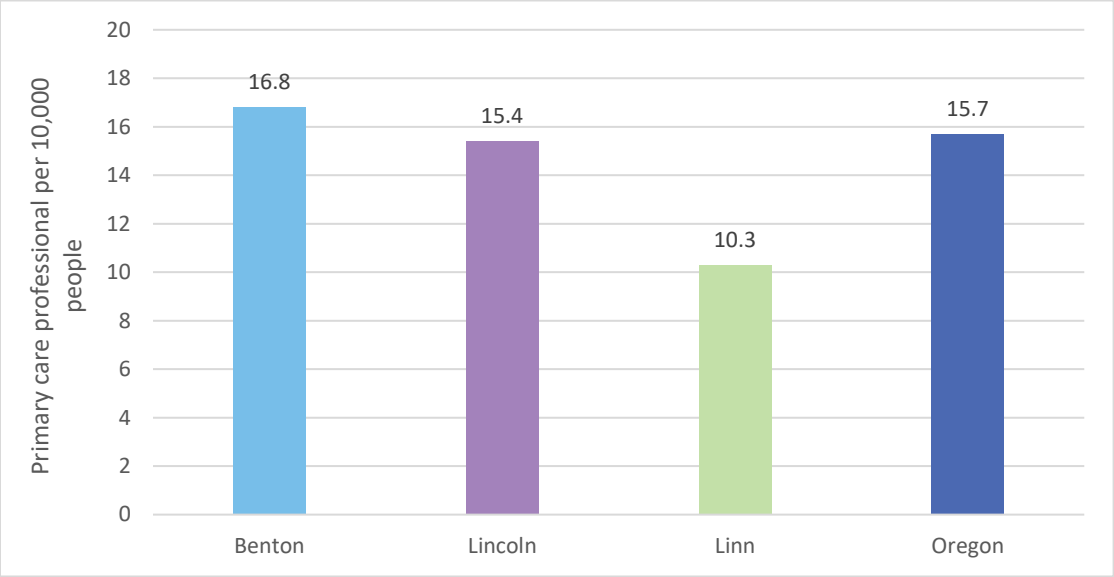
An adequate healthcare workforce is necessary for increasing access to care, improving patient experiences, and controlling service costs. The Association of American Medical Colleges has documented a growing concern in physician shortages due to an aging workforce, growing medical demands of served populations, and a limited number of new physicians being trained.[41] The COVID-19 pandemic has exacerbated the already dwindling number of physicians and has led to critical shortages in healthcare providers of all levels. It is anticipated that by 2034, an extra 37,800-124,000 physicians will be needed to adequately supply the American population with healthcare.[42]

Oregon's rural and frontier areas tend to have less access to healthcare providers and face greater barriers to accessing healthcare services.[43] Benton County has the greatest access to both primary care and behavioral health professionals. Despite making up only 35% of the LBL regional population, Benton County contains over 50% of all primary care physicians in the area. In contrast, Linn County residents make up 47% of the regional population but only 36% of the region's primary care physicians serve the area. Both Linn and Lincoln counties have fewer primary care professionals per 10,000 people than the state of Oregon (Figure 5-2). There is some overlap between the categorization of primary care and behavioral health professionals. Amongst the counties making up the LBL region, access to primary care and behavioral health providers follow similar trends, with Linn County having the least access per 10,000 people, followed by Lincoln County.

The terms 'mental health' and 'behavioral health' are at times used interchangeably, but while closely related, they do differ. Behavioral health describes the connection between a person's behaviors and the health and wellbeing of the body and mind,[44] while mental health refers only to one's emotional, psychological and social wellbeing.[45] There is some overlap between the categorization of mental health professionals and behavioral health professionals. In the LBL region, mental health providers were primarily located within city limits (Table 5-4). The city of Newport, located within Lincoln County, had the most mental health providers per 10,000 residents, although the county as a whole ranks below Benton County for access to mental health providers.

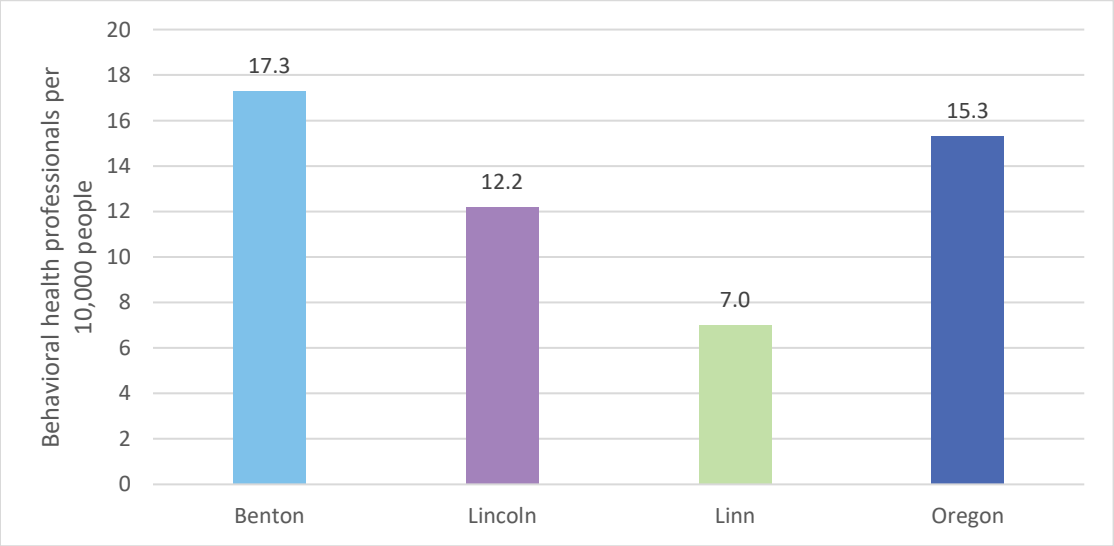
All three of the counties making up the LBL region had fewer dentists per 10,000 people than did the state of Oregon in 2020. Of the three counties, Lincoln has the greatest access to oral health providers, followed closely by Benton (Figure 5-4).

Figure 5-2. Primary care professionals per 10,000 people by location



Data source: Oregon's Health Care Workforce Reporting Program
Time period: 2020
For more information: https://www.oregon.gov/oha/HPA/ANALYTICS/HealthCareWorkforceReporting/2021-Workforce-Supply-for-web.pdf

Figure 5-3: Behavioral health professionals per 10,000 people by location



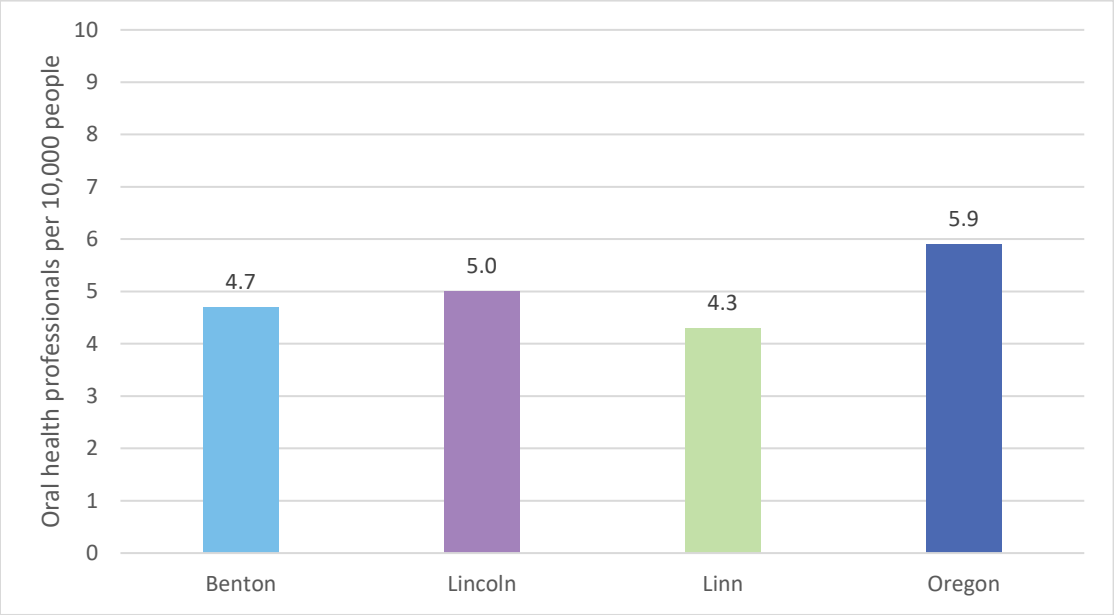
Data source: Oregon's Health Care Workforce Reporting Program
Time period: 2020
For more information: https://www.oregon.gov/oha/HPA/ANALYTICS/HealthCareWorkforceReporting/2021-Workforce-Supply-for-web.pdf

Table 5-4: Number of mental health professionals per 10,000 people by location

City	County	Mental Health Professionals per 10,000 people
Corvallis/Philomath	Benton	16.8
Monroe	Benton	0
Alsea	Benton	0
Newport	Lincoln	22.7
Lincoln City	Lincoln	9.7
Siletz	Lincoln	4.8
Waldport	Lincoln	3.5
Yachats	Lincoln	3.3
Toledo	Lincoln	2.8
Lebanon	Linn	3.0
Harrisburg	Linn	1.5
Sweet Home	Linn	1.0
Mill City/Gates	Linn	0.1
Brownsville	Linn	0
Scio	Linn	0
Albany	Linn/Benton	7.9
Oregon		12.5

Data source: Oregon Areas of Unmet Health Care Need Report
Time period: 2021
For more information: https://www.ohsu.edu/sites/default/files/2021-09/2021%20Areas%20of%20Unmet%20Health%20Care%20Needs%20Report%202.pdf

Figure 5-4: Number of oral health professionals per 10,000 people by location



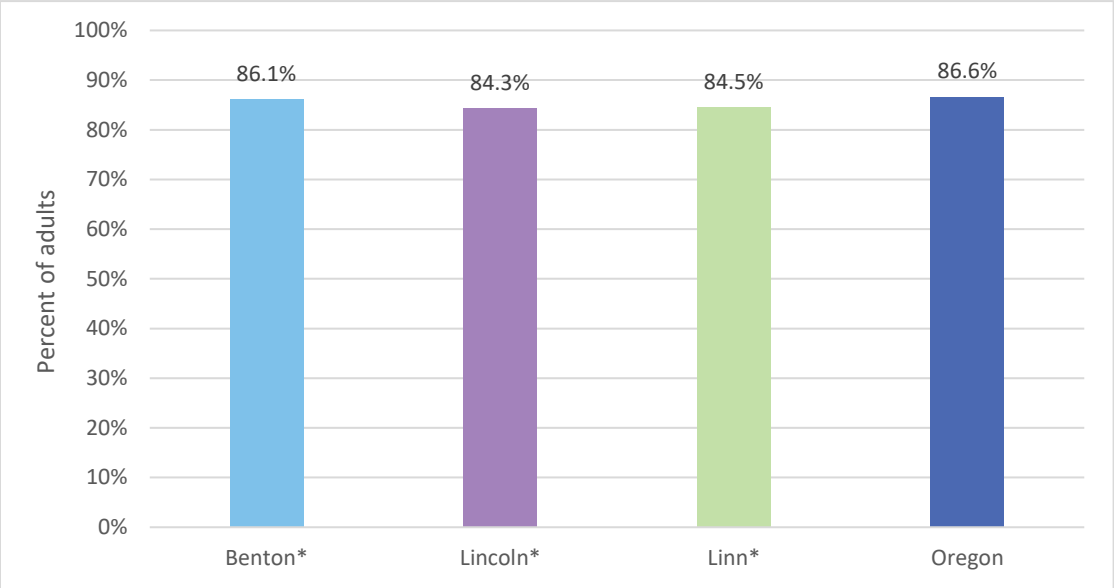
Data source: Oregon's Health Care Workforce Reporting Program
Time period: 2020
For more information: https://www.oregon.gov/oha/HPA/ANALYTICS/HealthCareWorkforceReporting/2021-Workforce-Supply-for-web.pdf

Preventive Services

The prevalence of chronic disease in the United States is an increasing concern among the medical community. Current statistics show that six out of every ten Americans will develop a chronic disease in their lifetime.[46] With the growing concern of chronic disease, medicine has shifted to focus on prevention. Screenings can identify the early warning signs of disease leading to improved prognosis and longer life expectancy. Current screening guidelines developed by American Heart Association recommend cholesterol screenings every 4-6 years beginning at age 20.[47] The United States Preventative Services Task Force recommends that women who are 50 to 74 years old and are at average risk for breast cancer get a mammogram every two years.[48] Although the percent of adults who follow screening guidelines varies by test, overall, Benton County residents were the most likely to follow screening guidelines in the region closely followed by Linn County. In addition to laboratory screenings, guidelines recommend routine annual exams with medical providers and annual prophylaxis dental cleanings to help prevent disease. Linn County had the highest percent of adults with a preventative doctor visit in the LBL region, and Benton County had the highest percent of adults who visited a dentist in the previous year.

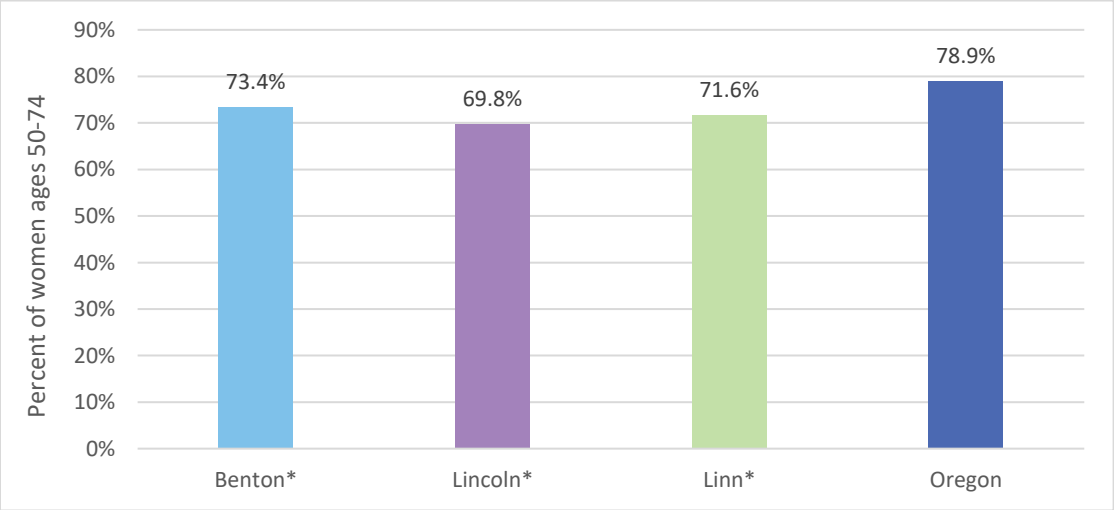
Much of the data in this section comes from the CDC's PLACES estimates based on the Behavioral Risk Factor Surveillance System (BRFSS). PLACES is a small area estimation approach that produces county-level results based on statistical modeling of all available survey responses. For more information on PLACES methodology, see https://www.cdc.gov/places/methodology/index.html.

Figure 5-5: Age-adjusted percent of adults who received cholesterol screening within the past five years by location



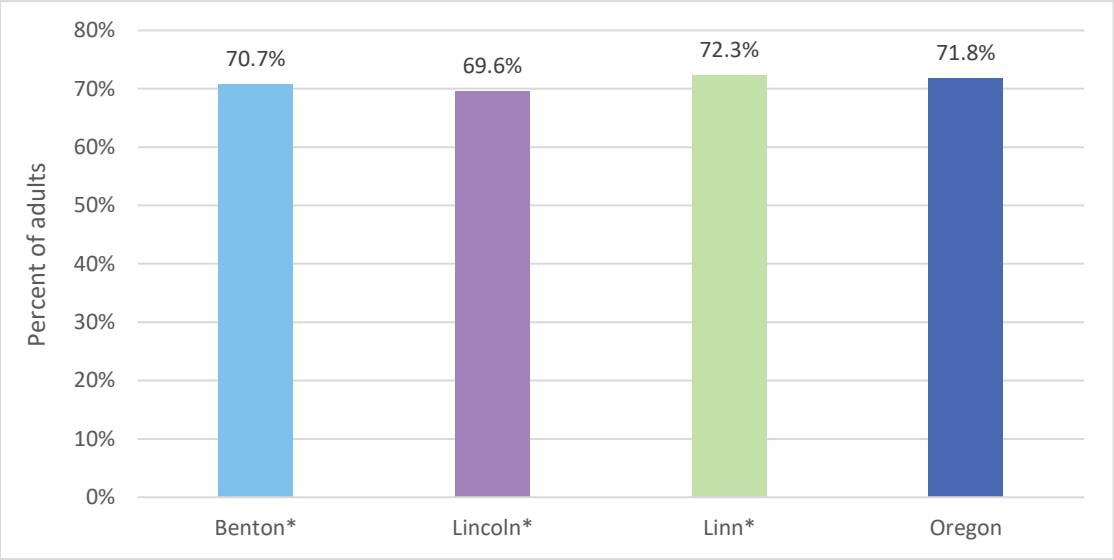
**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*
Data source: Behavioral Risk Factor Surveillance System PLACES
Time period: 2020
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Figure 5-6: Age-adjusted percent of women ages 50-74 who received a mammogram within the past two years by location



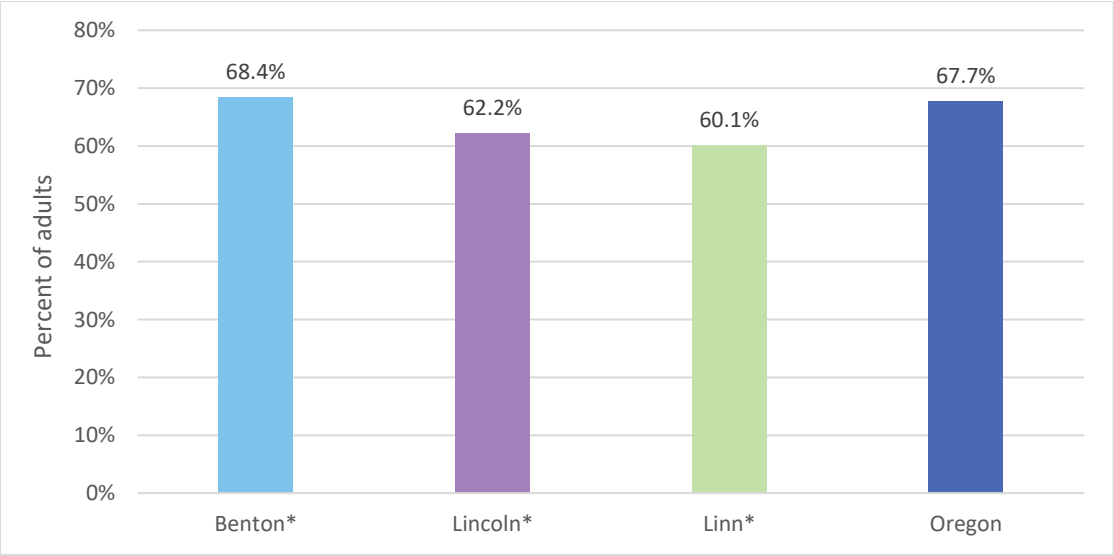
**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*
Data source: Behavioral Risk Factor Surveillance System PLACES
Time period: 2020
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Figure 5-7: Age-adjusted percent of adults who visited a doctor for a routine check-up within the past year by location



**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*
Data source: Behavioral Risk Factor Surveillance System PLACES
Time period: 2020
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Figure 5-8: Age-adjusted percent of adults who visited the dentist within the past year by location



**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*
Data source: Behavioral Risk Factor Surveillance System PLACES
Time period: 2020
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Oregon Health Plan (Medicaid): InterCommunity Health Network Coordinated Care Organization (IHN-CCO)

The Oregon Health Plan (OHP) is Oregon's Medicaid program. The Oregon Health Authority established a network of Coordinated Care Organizations (CCOs) as Medicaid managed care organizations to coordinate services for people covered by the Oregon Health Plan. InterCommunity Health Network Coordinated Care Organization (IHN-CCO), established in 2012, is responsible for managing care for OHP members in the LBL region. The Medicaid population in Oregon, like the rest of the country, is primarily low-income. Studies have found that Medicaid recipients face greater barriers to care and generally have worse health status than people with commercial insurance.[49, 50]

CCOs participate in an annual Consumer Assessment of Healthcare Providers Survey (CAHPS) to measure accessibility of healthcare services. Table 5-5 includes results for IHN-CCO members surveyed in 2021. Most surveyed IHN enrollees reported having adequate access to necessary health services in a timely manner, though perceived access to specialized therapy and medical equipment was lower.

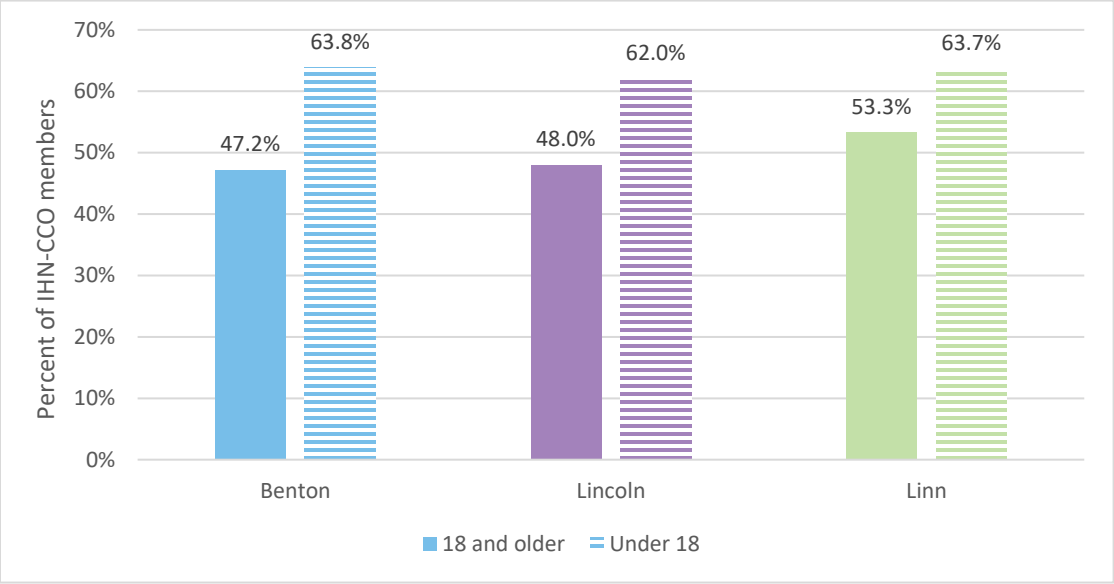
People covered by Medicaid have been shown to have greater emergency department utilization than persons insured through a private provider.[51] In 2021, approximately 23% of all IHN-CCO members visited an emergency department at least once (Figure 5-10).

Table 5-5: IHN-CCO Consumer Assessment of Healthcare Providers survey results

	Never	Sometimes	Usually	Always
How often did you get an appointment for a check-up or routine care as soon as you needed?	3.3%	16.8%	26.6%	53.2%
How often was it easy to get the care, tests, or treatment you needed?	2.2%	13.8%	32.8%	51.2%
How often did you get an appointment with a specialist as soon as you needed?	5.5%	15.6%	30.6%	48.2%
How often was it easy to get the special therapy you needed through your health plan?	13.7%	14.8%	26.2%	45.3%
How often was it easy to get the medical equipment you needed through your health plan?	18.5%	16.4%	20.8%	44.3%

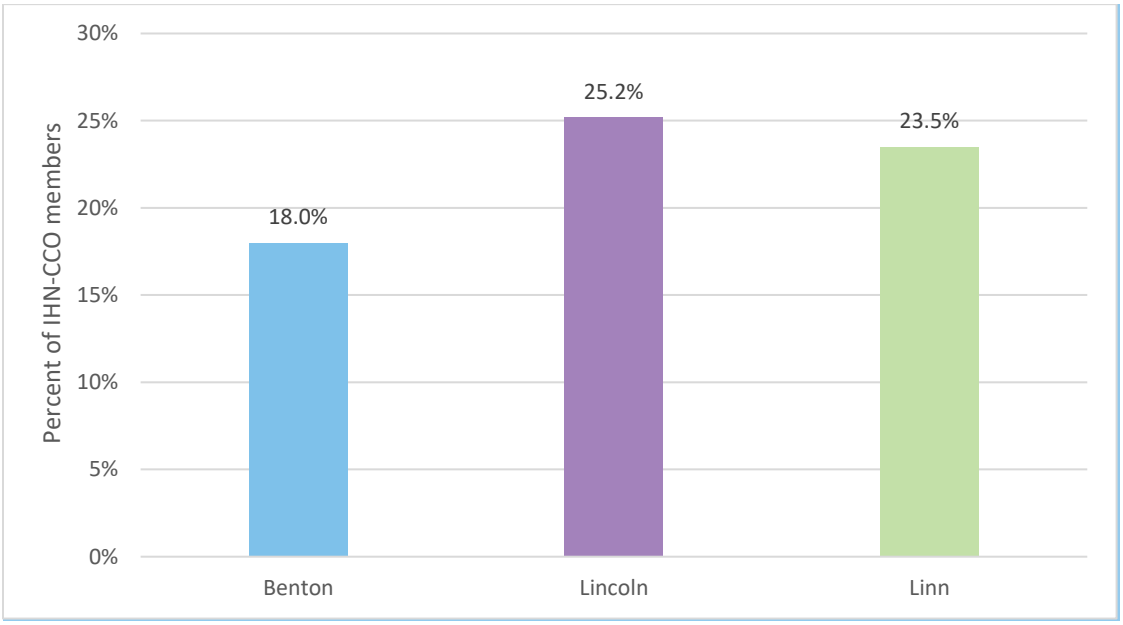
Data source: InterCommunity Health Network CCO 2021 Consumer Assessment of Healthcare Providers Survey
Time period: 2021
For more information:
https://www.oregon.gov/oha/HPA/ANALYTICS/CAHPS%20documents/InterCommunity%20Health%20Network%202020%20(Adult).pdf

Figure 5-9: Percent of IHN-CCO members with a dental claim in the past year by age category and location



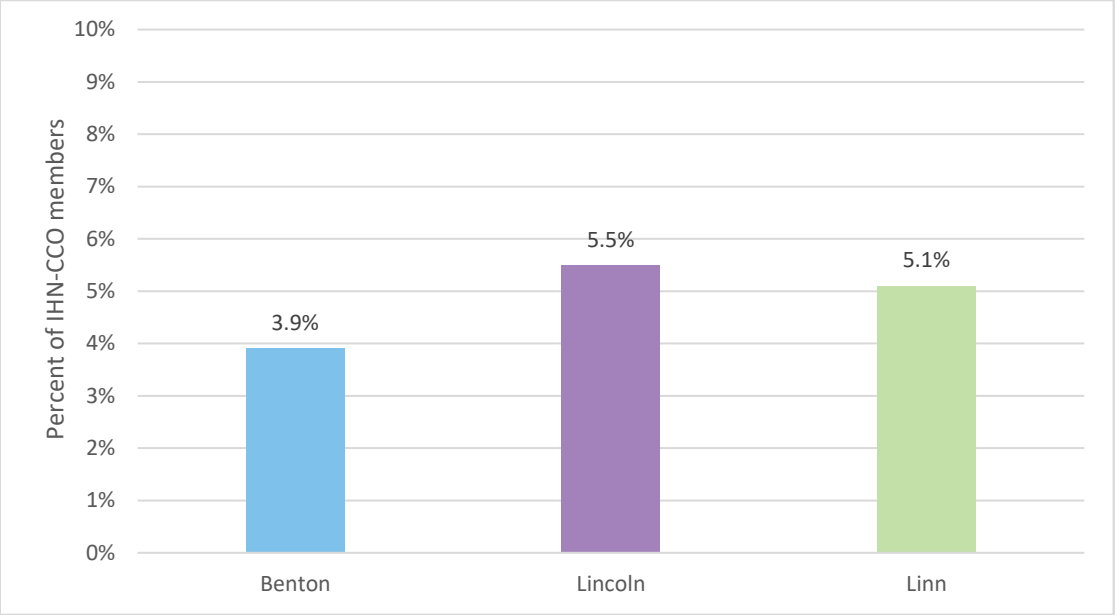
Data source: IHN-CCO claims data
Time period: 2021
For more information: email SHSresearch@samhealth.org

Figure 5-10: Percent of IHN-CCO members with at least one visit to an emergency department in the past year by location



Data source: IHN-CCO claims data
Time period: 2021
For more information: email SHSresearch@samhealth.org

Figure 5-11: Percent of IHN-CCO members with five or more visits to an emergency room in the past year by location



Data source: IHN-CCO claims data
Time period: 2021
For more information: email SHSresearch@samhealth.org

6 Morbidity and Mortality

Traditional measures used to evaluate the health of populations are morbidity (rate of disease) and mortality (deaths). Data on the leading causes of illness and death within a population can equip those seeking to improve the health of communities with information needed to prevent loss of life and improve quality of life. This chapter will present data on leading causes of death and occurrence of chronic and infectious disease with the exclusion of COVID-19 data, which can be found in Chapter 9: COVID-19.

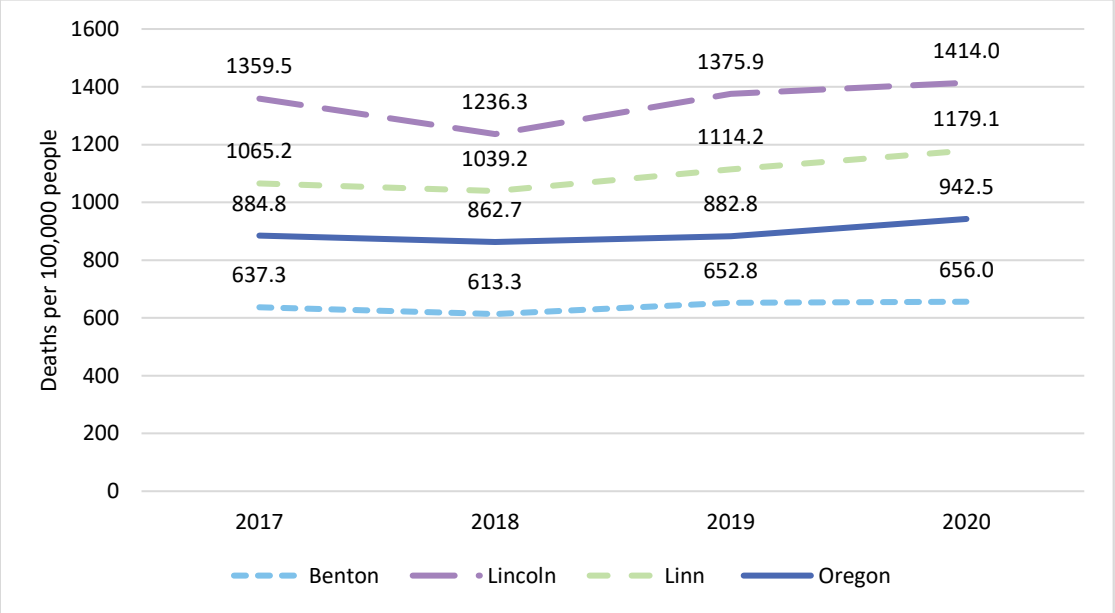
Mortality

Mortality is a measure of the number of deaths in a population. Crude death rate measures the number of deaths in a particular population per 100,000 people and is one way to capture mortality data. In 2020, all three counties making up the LBL region experienced their highest crude death rate since 2017. Lincoln County's crude death rate in 2020 was 1,414 deaths per 100,000 residents, the highest in the LBL region. Both Lincoln and Linn county's death rates exceeded that of the state average from years 2017-2020.

As would be expected, crude death rate increased substantially with age in all counties making up the LBL region. In 2020, men made up the greatest proportion of deaths in Linn County, Lincoln County, and the state of Oregon. Benton County's crude death rate was comparable between genders, with slightly fewer females having died in 2020.

Unfortunately, data on death rates by race/ethnicity were not available at the time of this report's release. The Oregon Health Authority (OHA) has a dashboard with county-specific mortality rates by race/ethnicity, but accurate data was not available when this report was drafted. Mortality data by race/ethnicity should be available at the following link once data has been updated and released by OHA:
https://visualdata.dhsoha.state.or.us/t/OHA/views/CountyDash/CountyDash_cause?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=

Figure 6-1: Number of deaths per 100,000 people by year and location (crude death rate)



Data source: OHA Center for Health Statistics
Time period: 2017-2020
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/CountyDash/CountyDash_cause?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n

Table 6-1: Number of deaths per 100,000 people by age group and location

Age (years)	Benton	Lincoln	Linn	Oregon
0-4	*	*	164.9	86.5
5-14	*	*	*	11.8
15-24	*	*	121.3	73.0
25-34	*	221.6	122.2	127.2
35-44	158.7	426.9	244.8	179.5
45-54	279.5	569.6	288.1	381.7
55-64	452.6	953.2	1,167.2	869.0
65-74	1,238.7	2,015.9	2,117.9	1,750.6
75-84	2,976.9	4,034.8	5,006.9	4,389.1
85+	11,326.1	13,572.0	17,032.4	14,121.4

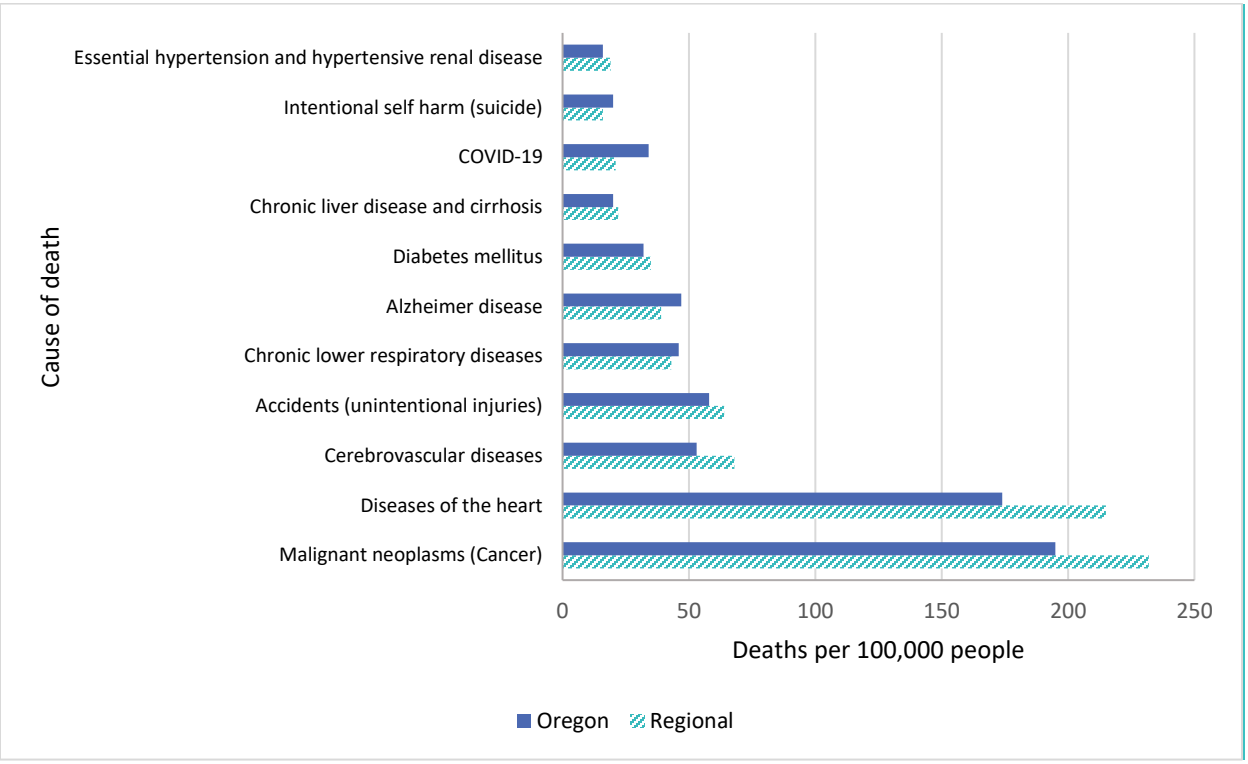
**Unreliable due to small numbers*
Data source: Oregon Public Health Assessment Tool
Time period: 2020
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/LeadingCausesDash/LeadingDash1?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n

Leading Causes of Death

The leading cause of death in the LBL region is cancer, followed by diseases of the heart and cerebrovascular diseases (Figure 6-3). Nationally, the most common disease of the heart is coronary heart disease, which occurs when arteries supplying blood to the heart narrow or harden from the formation of plaque. Cerebrovascular disease refers to a group of conditions that affect blood flow to the brain. Lack of sufficient blood flow affects brain tissue and may cause a stroke. Coronary heart disease, stroke, and many types of cancer are preventable with lifestyle changes.

The leading causes of death vary slightly across the three counties making up the LBL region. The leading cause of death in both Lincoln and Benton counties is cancer, followed by diseases of the heart. In Linn County, the leading cause of death is diseases of the heart, followed closely by cancer (Table 6-3).

Figure 6-2: Leading causes of death per 100,000 people comparison of Oregon and Linn-Benton-Lincoln Region



Data source: Oregon Public Health Assessment Tool
Time period: 2020
For more information: Contact the Benton County Health Department

Table 6-2: Number of deaths per 100,000 people by leading causes of death and location

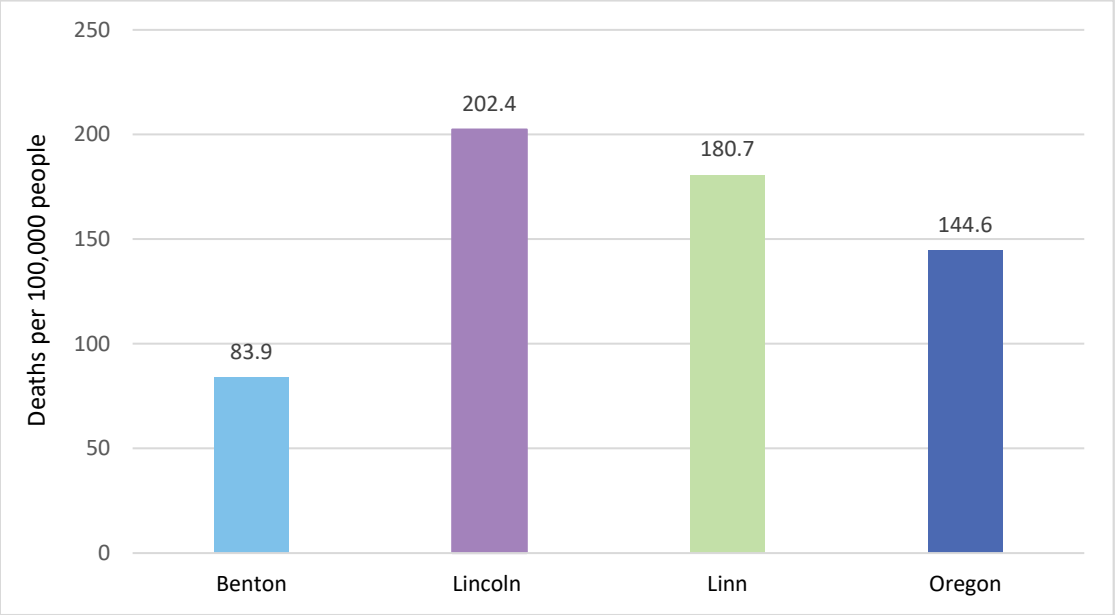
Cause of Death	Benton	Lincoln	Linn	Oregon
Malignant neoplasms (cancer)	152.1	356.1	253.7	194.2
Diseases of the heart	138.4	262.9	262.3	172.7
Cerebrovascular diseases	35.9	66.3	94.3	52.4
Accidents (unintentional injuries)	34.9	105.6	72.3	57.8
Alzheimer Disease	34.9	39.3	44.0	47.1
Diabetes mellitus	21.1	72.5	33.0	31.8
Chronic lower respiratory diseases	18.0	76.6	51.1	46.1
Chronic liver disease and cirrhosis	12.7	43.5	22.0	19.5
COVID-19	10.6	29.0	27.5	33.6
Essential hypertension and hypertensive renal disease	10.6	24.8	24.3	15.8
Intentional self-harm (suicide)	9.5	29.0	17.3	19.6

Data source: OHA Center for Health Statistics
Time period: 2020
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/CountyDash/CountyDash_cause

Tobacco-Related Mortality

Tobacco use is the number-one cause of preventable death and disease in Oregon.[52] Each year, tobacco use kills over 8,000 Oregonians and costs almost $5.7 billion in medical expenses and lost productivity. In Linn and Lincoln counties, tobacco was responsible for an average of 180.7 and 202.4 deaths per 100,000 people respectively from years 2017 to 2020. These rates exceeded that of Oregon and far exceeded that of Benton County, which experienced an average of 83.9 deaths related to tobacco use per 100,000 people from years 2017 to 2020 (Figure 6-4).

Figure 6-3: Age-adjusted number of deaths per 100,000 people related to tobacco use by location

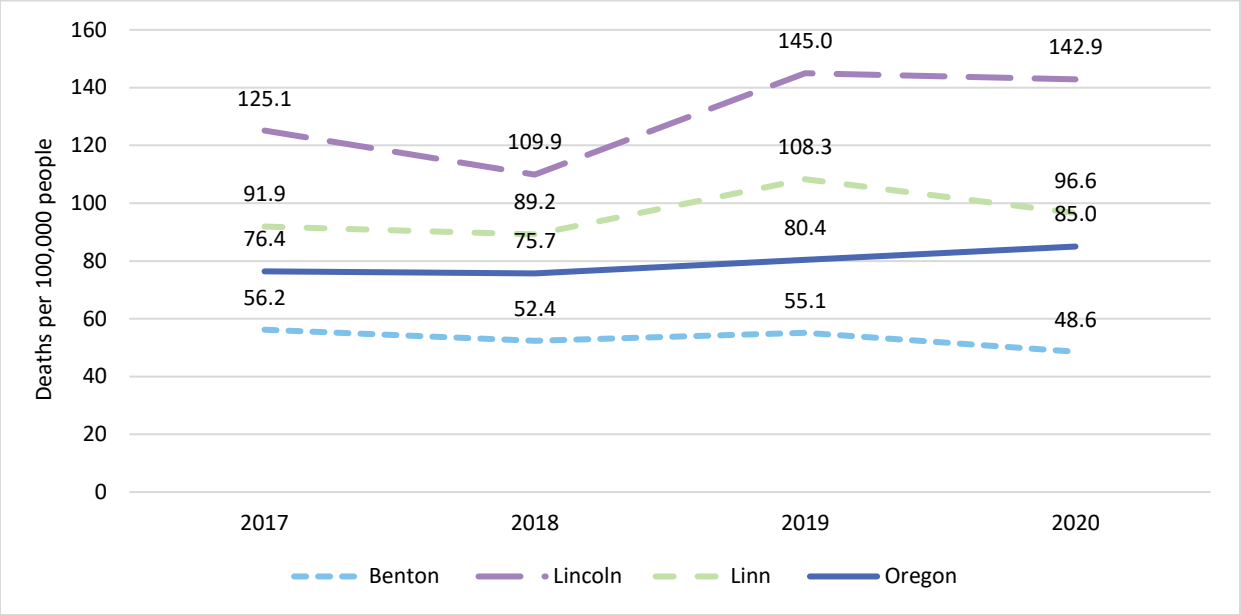


Data source: OHA Center for Health Statistics
Time period: 2017-2020
For more information: https://www.oregon.gov/oha/ph/preventionwellness/tobaccoprevention/pages/oregon-tobacco-facts.aspx

Injury

Injury is the leading cause of death for Oregonians between the ages 1 and 44. Unintentional injury is the fourth leading cause of death among those of all ages in the LBL region (Table 6-3). From years 2017-2020, Lincoln County experienced the highest rate of injury deaths in the LBL region, followed by Linn County. Falls accounted for the greatest number of injury deaths in the LBL region, but these rates vary drastically by county. In 2020, Lincoln County experienced 1.5 and 2.9 times the number of deaths from falls as Linn and Benton counties respectively. Overdose/poisoning is the second leading cause of injury death in the region and was the leading cause of injury death in Linn County in 2020. During that year, Linn County experienced 25.1 deaths from overdose/poisoning per 100,000 people (Table 6-4).

Figure 6-4: Number of injury deaths per 100,000 people by location



Date source: OHA Center for Health Statistics
Time period: 2017-2020
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/Oregondeathsfromexternalinjuries/CountyDash?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n

Table 6-3: Number of injury deaths per 100,000 people by leading causes of injury deaths and location

Cause of Injury Death	Benton	Lincoln	Linn	Oregon
Fall	23.2	55.9	19.6	19.5
Poisoning/Overdose	7.4	22.8	25.1	21.1
Transportation	7.4	22.8	19.6	13.6
Firearm	5.3	14.5	9.4	13.9
Suffocation	3.2	10.4	8.6	6.7
Drowning	0	8.3	4.7	2.0
Contact with Object	0	4.1	1.6	1.5
Medical Care Complications	2.1	0	0.8	1.9

Data source: OHA Center for Health Statistics
Time period: 2020
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/Oregondeathsfromexternalinjuries/CountyDash?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n

Homicide

Injuries can be split into two categories, intentional and unintentional. Intentional injuries are comprised of homicides, suicides, and some undetermined deaths. From years 2017 to 2020, the LBL region experienced 29 homicides total. During this time, Benton County experienced 4 homicides, Lincoln County experienced 5 homicides, and Linn County experienced 20 homicides. Suicides account for a greater number of deaths in the region than do homicides. The region's suicide deaths will be explored in Chapter 8: Mental and Behavioral Health.

Chronic disease

A chronic disease is a condition that lasts at least one year and requires ongoing medical attention. Chronic diseases including heart disease, cancer, and diabetes are the leading causes of death in the United States.[53] Many chronic diseases can be prevented through lifestyle changes that target risk behaviors like tobacco use, poor nutrition, lack of physical activity, and excessive alcohol use. These individual choices however can be greatly constrained by the characteristics of one's community and life circumstances. Chapter 4: Social Determinants of Health includes data on characteristics of the three counties that may influence community members' ability to make positive health choices.

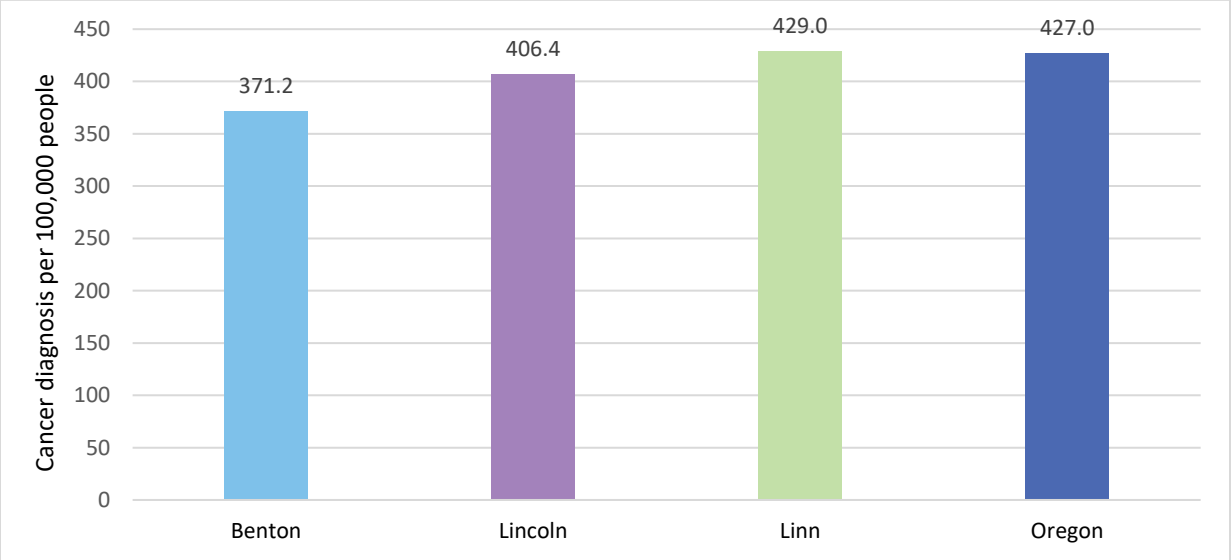
Cancer

Cancer is the leading cause of death in the LBL region and the state of Oregon. Each year, approximately 430 per 100,000 people in Oregon receive a cancer diagnosis and approximately 150 per 100,000 people die each year from cancer in the state. The LBL region's age-adjusted rate of newly diagnosed cancer cases range from 371.2 diagnoses per 100,000 people annually in Benton County to 429.0 diagnoses per 100,000 people annually in Linn County (Figure 6-5). On average, the LBL region experienced fewer cancer diagnoses than the state of Oregon. While Linn County's rate of cancer diagnosis is the highest in the region, its cancer mortality rate is comparable to that of Lincoln County. Annual cancer deaths ranged from 128.6 deaths per 100,000 people in Benton County to 172.5 cancer deaths per 100,000 people in Linn County over the years 2016-2020 (Figure 6-6). Note the difference between crude (unadjusted) mortality rates, as shown in Table 6-2, and age-adjusted mortality rates, as shown in Figure 6-6. The differences in mortality rates between Lincoln County and Benton County are much larger using crude mortality rates than with age-adjusted mortality rates, since the population in Lincoln County is substantially older than the population in Benton County. After adjusting for differences in the age of each county's population, the rates of cancer death experienced in each county of the LBL region are more similar.

Breast cancer makes up the largest proportion of cancer diagnoses in the LBL region, followed by prostate and lung and bronchus cancers (Table 6-4). From 2015 to 2019, Benton County experienced a high incidence (new occurrence) of breast cancer diagnosis, approximately 1.3 times higher than Linn and Lincoln counties. Despite its high incidence of breast cancer diagnosis, Benton County's breast cancer mortality rate was the same as the state of Oregon, and below that of Lincoln County during years 2016 to 2020. Lung cancer was the leading cause of cancer deaths in Oregon and in the LBL region from years 2016-2020. Both Linn and Lincoln counties experience higher rates of death from lung and bronchus cancers than the state and a far greater number than Benton County (Table 6-5). The leading

risk factor for lung cancer is smoking; it's estimated that about 80% of lung cancer deaths are the result of smoking.[54]

Figure 6-5: Age-adjusted number of cancer diagnoses per 100,000 people by location



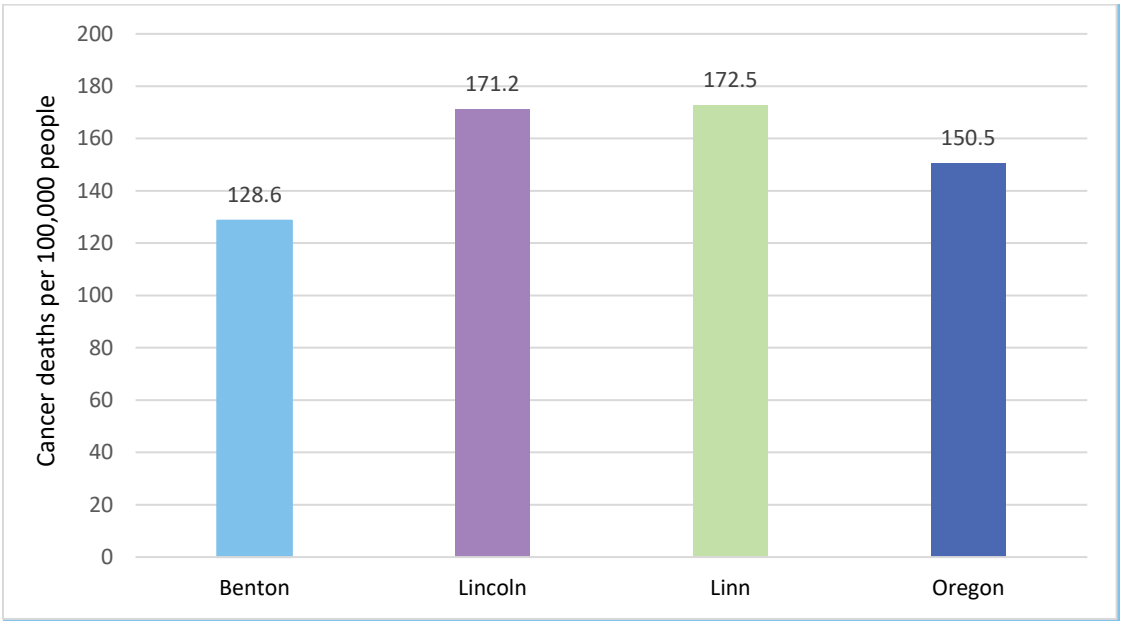
Data source: Oregon State Cancer Registry
Time period: 2015-2019
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Cancer-Incidence.aspx

Table 6-4: Age adjusted number of cancer diagnoses per 100,000 people by cancer type and location

Cancer Type	Benton	Lincoln	Linn	Oregon (2019)
Breast	159.1	120.4	116.7	134.6
Prostate	91.0	97.7	109.6	96.4
Lung and Bronchus	31.7	53.8	57.0	46.5
Colon and Rectum	26.6	31.9	32.8	32.1
Corpus and Uterus (not otherwise specified)	29.4	25.6	33.9	30.2
Non-Hodgkin Lymphoma	15.8	19.1	19.2	16.9
Urinary Bladder	19.5	27.8	25.5	19.9

Data source: Oregon State Cancer Registry
Time period: Counties, annual average for 2015-2019; Oregon, 2019 only
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Cancer-Incidence.aspx

Figure 6-6: Age adjusted number of cancer deaths per 100,000 people by location



Data source: OHA Center for Health Statistics
Time period: 2016-2020
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Cancer-Incidence.aspx

Table 6-5: Age-adjusted number of cancer deaths per 100,000 people by cancer type and location

Cancer Type	Benton	Lincoln	Linn	Oregon (2020)
Breast	18.5	22.4	17.3	18.5
Colon and Rectum	11.4	15.1	11.9	11.2
Lung and Bronchus	24.2	43.6	43.9	30.8
Liver and Intrahepatic Bile Duct	4.1	7.1	8.5	6.8
Ovary	7.8	8.3	8.8	6.1
Pancreas	11.2	13.3	11.9	10.9
Prostate	20.7	15.1	23.0	18.9

Data source: OHA Center for Health Statistics
Time period: Counties, annual average for 2016-2020; Oregon, 2020 only
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Cancer-Incidence.aspx

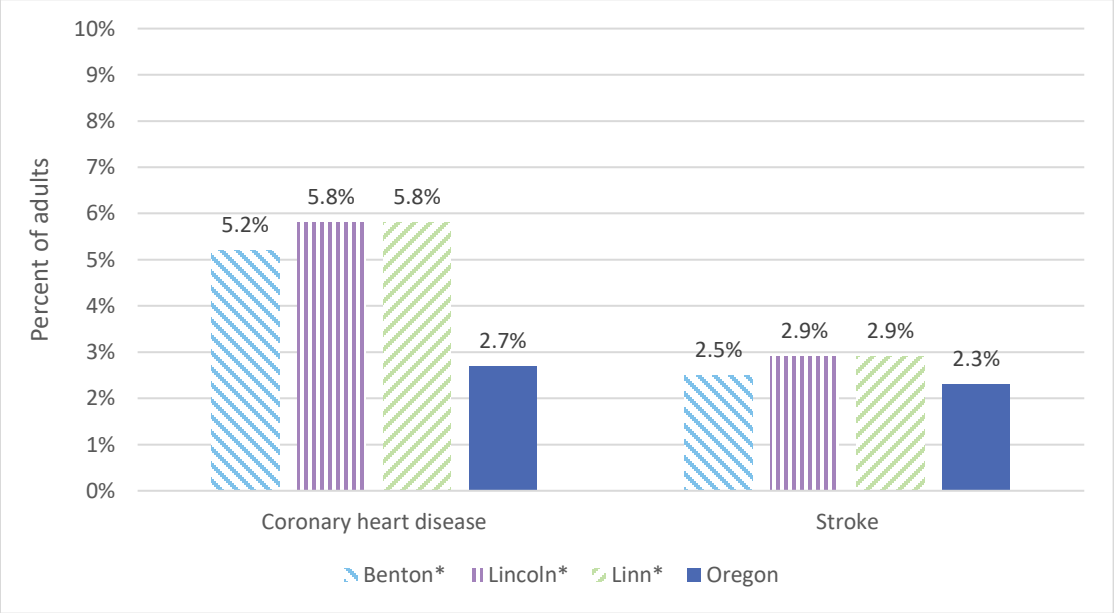
Heart Disease and Stroke

Heart disease is the leading cause of death in the United States and the second leading cause of death in Oregon and the LBL region (Figure 6-3). Heart disease refers to several types of heart conditions, including coronary heart disease, which is the most common type of heart disease. Coronary heart disease is more common in the LBL region than in the state of Oregon on average.

Stroke is the most common type of cerebrovascular disease, resulting from restriction of blood flow to the brain. Cerebrovascular diseases are a leading cause of death in the state of Oregon and in the LBL region (Figure 6-3). Based on PLACES county estimates from 2020, the three counties making up the LBL region experienced a comparable total number of strokes (Figure 6-8). Among those 35 and older, more people died from heart disease and stroke in 2018-2020 in Linn County than in Lincoln or Benton counties. Lincoln County's mortality rate for heart disease and stroke were similar to the state of Oregon, while Benton County's were lower (Figure 6-9).

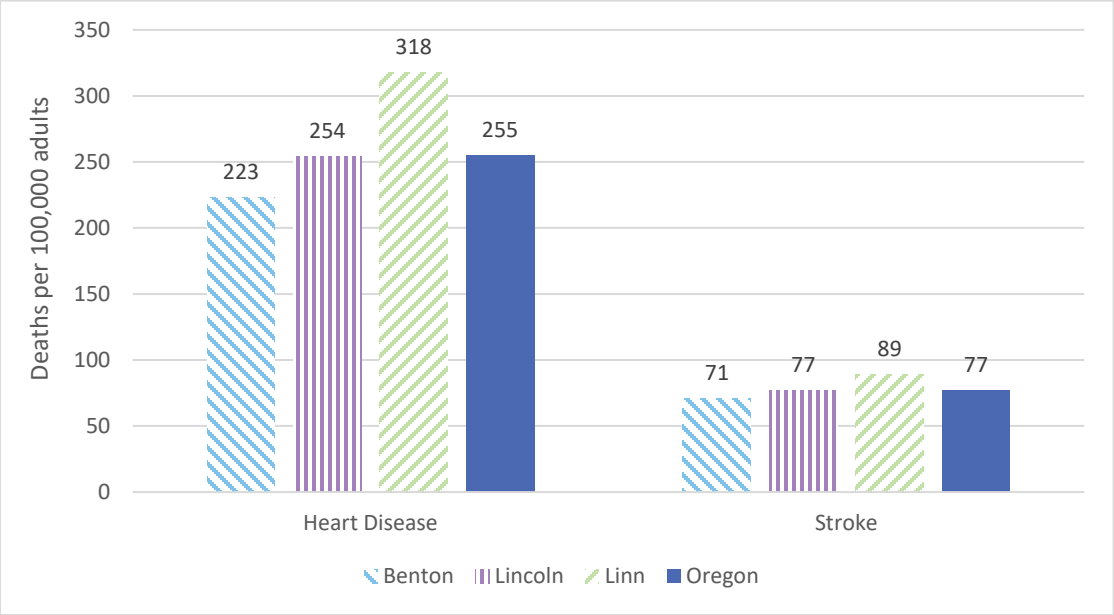
Oregon's Black population has the highest mortality rates from heart disease and stroke when compared to other race/ethnicity groups (Table 6-7 and 6-8). Due to insufficient data, trends in heart disease and stroke mortality by race/ethnicity in the LBL region can't be analyzed fully. Based on the data available, non-Hispanic Whites have the highest mortality rate from heart disease and stroke in the region. Rates of heart disease and stroke also vary by gender. In the region, men are much more likely to die from heart disease than are women, while women in the region (with the exception of Lincoln County) are more likely than men to die from stroke (Figure 6-10 and 6-11).

Figure 6-7: Age adjusted percent of adults who have ever experienced coronary heart disease or stroke by location



**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*
Data source: Behavioral Risk Factor Surveillance System PLACES
Time period: 2020
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Figure 6-8: Number of deaths per 100,000 adults 35 years and older from heart disease or stroke by location



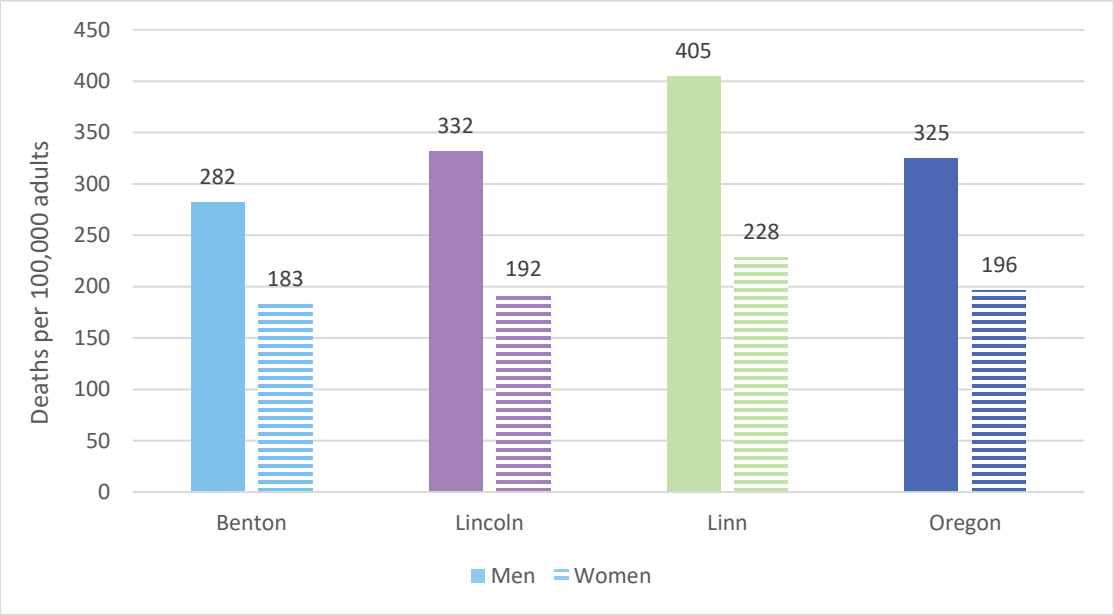
Data source: Interactive Atlas of Heart Disease & Stroke, CDC Division for Heart Disease and Stroke Prevention
Time period: 2018-2020
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Heart-Disease-and-Stoke-Deaths.aspx

Table 6-6: Number of deaths per 100,000 adults 35 and older from heart disease by race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian / Alaska Native	195	173	247	208
Asian Pacific Islander	119	138	279	133
Black	219	*	241	287
Hispanic	115	164	97	133
White	234	260	325	264

**Unreliable due to small numbers*
Data source: Interactive Atlas of Heart Disease & Stroke, CDC Division for Heart Disease and Stroke Prevention
Time period: 2018-2020
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Heart-Disease-and-Stoke-Deaths.aspx

Figure 6-9: Number of deaths per 100,000 adults 35 and older from heart disease by gender and location



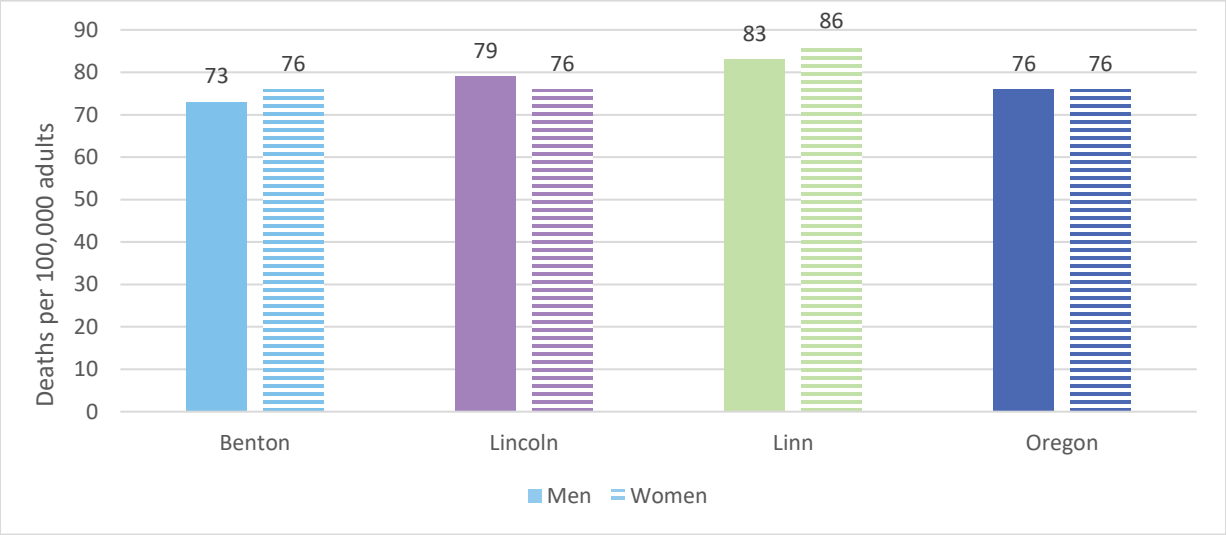
Data source: Interactive Atlas of Heart Disease & Stroke, CDC Division for Heart Disease and Stroke Prevention
Time period: 2018-2020
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Heart-Disease-and-Stoke-Deaths.aspx

Table 6-7: Number of deaths per 100,000 adults 35 years and older from stroke by race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	*	*	*	63
Asian or Pacific Islander	50	90	73	85
Black	*	*	*	118
Hispanic	53	50	65	60
White	76	78	87	76

**Unreliable due to small numbers*
Data source: Interactive Atlas of Heart Disease & Stroke, CDC Division for Heart Disease and Stroke Prevention
Time period: 2018-2020
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Heart-Disease-and-Stoke-Deaths.aspx

Figure 6-10: Number of deaths per 100,000 adults 35 and older from stroke by gender and location



Data source: Interactive Atlas of Heart Disease & Stroke, CDC Division for Heart Disease and Stroke Prevention
Time period: 2018-2020
For more information:
https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Pages/Heart-Disease-and-Stoke-Deaths.aspx

Both heart disease and stroke have risk factors that are largely modifiable with lifestyle change including high blood pressure, high cholesterol, diabetes, and obesity. PLACES estimates from years 2019 and 2020 find that the LBL region experienced rates of these risk factors similar to the state average. With the exception of high cholesterol, Benton County had the lowest estimated rates of these risk factors, falling below the state average in most conditions. Linn and Lincoln counties had similar estimated rates, in most cases with higher rates than the state average (Table 6-9). Smoking is another risk factor for heart disease and stroke, as well as numerous additional chronic diseases. Rates of smoking in the LBL region will be explored in Chapter 8: Mental & Behavioral Health.

Table 6-8: Age adjusted percent of adults with risk factors for heart disease and stroke by location

Risk Factor	Benton*	Lincoln*	Linn*	Oregon
High blood pressure	25.8%	28.8%	29.2%	27.5%
High cholesterol	25.8%	25.4%	24.2%	26.0%
Diabetes	8.2%	8.8%	8.8%	8.4%
Obesity	28.5%	32.4%	33.3%	28.1%

**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*
Data source: Behavioral Risk Factor Surveillance System PLACES
Time period: Cholesterol and high blood pressure data 2019, diabetes and obesity data 2020
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Infectious Illnesses (Non-COVID)

Prevention and control of infectious illnesses rank among the greatest health advances of the 20th century. The World Health Organization defines infectious diseases as those that are caused by bacteria, viruses, parasites, or fungi; and can be passed from person to person.[55] Some are transmitted via ingesting contaminated food or water, many are spread by microorganisms in coughs or sneezes, and others result from exposures in the environment or insect bites. Diseases that spread from animals are called zoonotic infections. Infectious illnesses are representative of the overall health and wellness of a community through prevention efforts and transition data represented below.

For reference, here are the diseases listed in the graphs below and their associations:

Campylobacteriosis. A bacteria carried by infected livestock which causes a food borne illness from underprepared, contaminated food. It is the most common bacterial cause of diarrheal illness in the United States. For more information visit https://www.cdc.gov/campylobacter/faq.html.

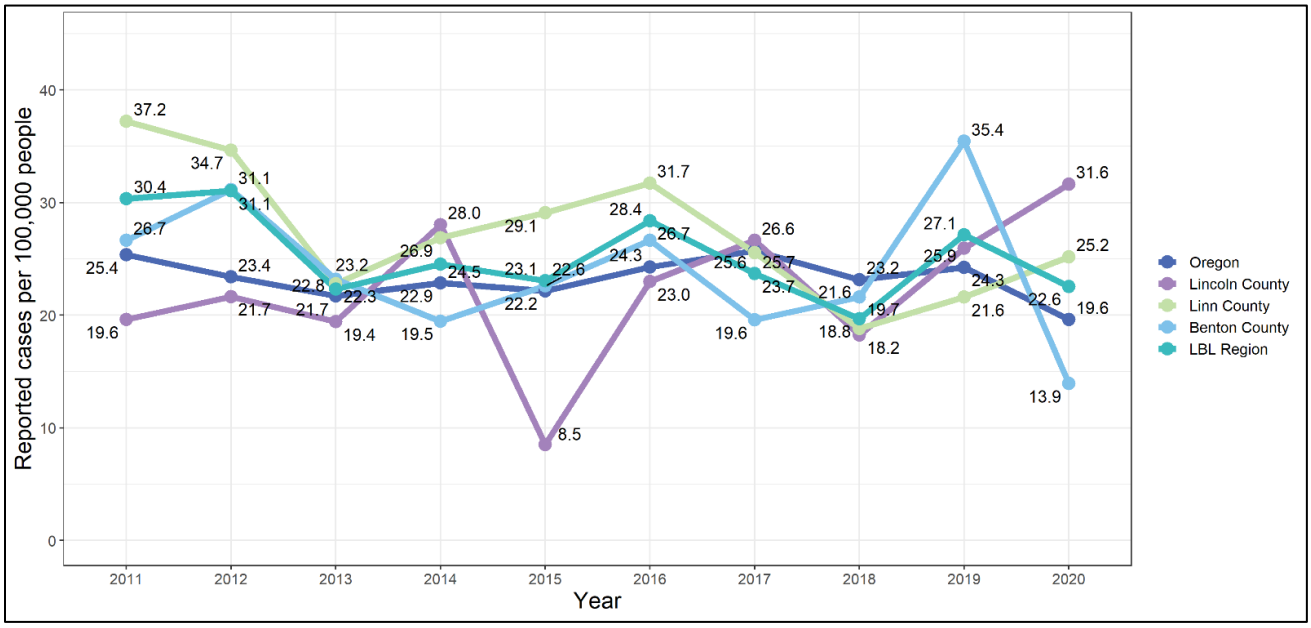
E.Coli. A group of large and diverse group of bacteria with many different strains, some of which can cause severe food borne illness, specifically Shinga Toxin-Producing E.Coli (STEC) from sources such as raw/undercooked meat and fecal contamination of vegetables. For more information visit https://www.who.int/news-room/fact-sheets/detail/e-coli.

Chlamydia. A common STD for both men and women that causes infection which can cause damage to the reproductive center of a woman if left untreated. For more information visit https://www.cdc.gov/std/chlamydia/stdfact-chlamydia.htm.

Gonorrhea. A common STD that causes infection in the genitals, rectum, and throat for both men and women. For more information visit https://www.cdc.gov/std/gonorrhea/Gonorrhea-FS.pdf.

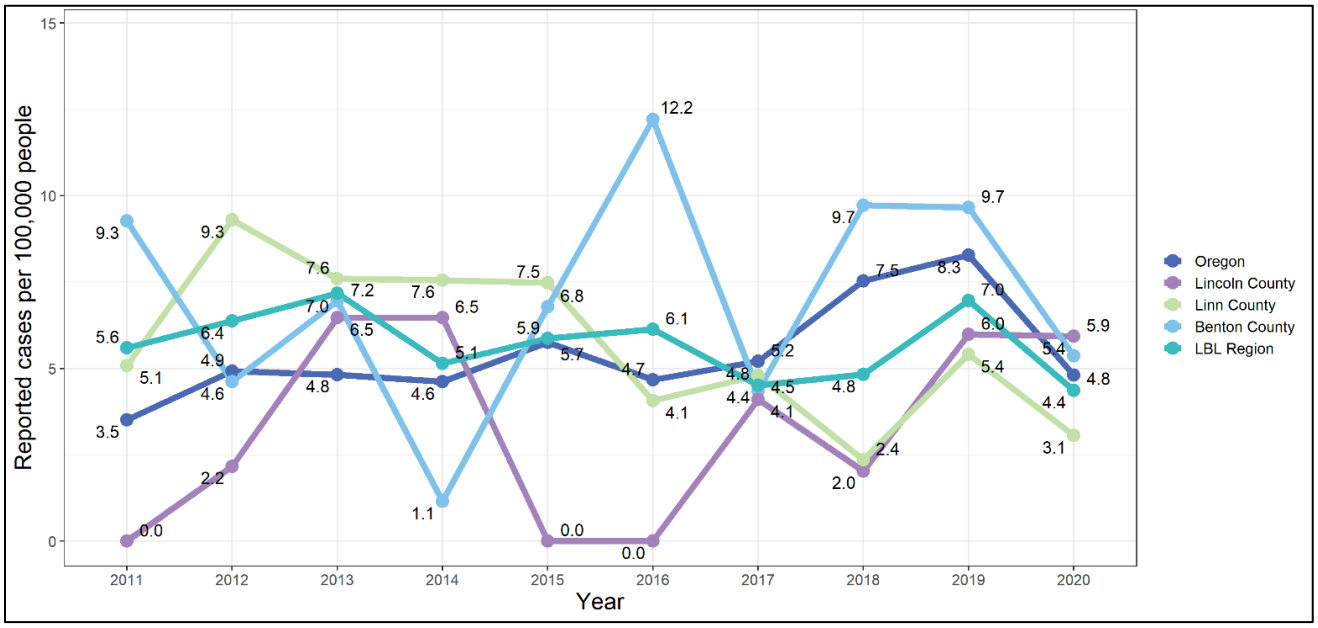
Syphilis. A STD that causes infection to develop in stages and can cause serious health problems without treatment. For more information visit https://www.cdc.gov/std/syphilis/stdfact-syphilis.htm

Figure 6-11: Reported cases of campylobacteriosis per 100,000 people by year and location



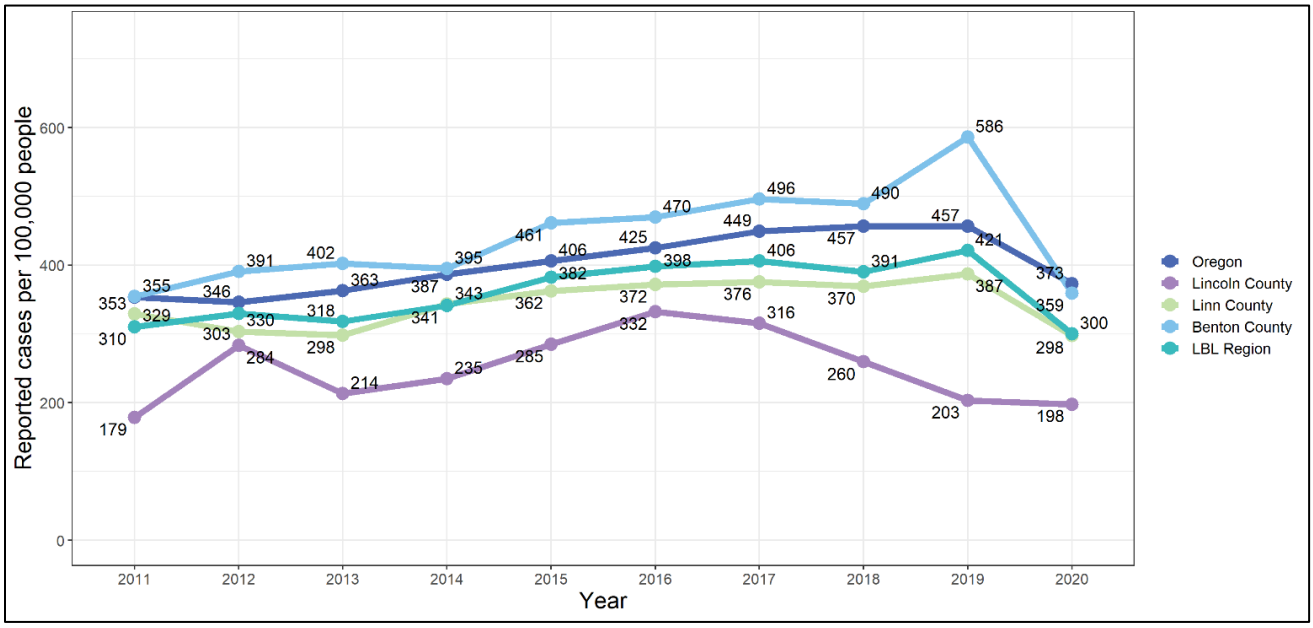
Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Figure 6-12: Reported cases of E. coli per 100,000 people by year and location



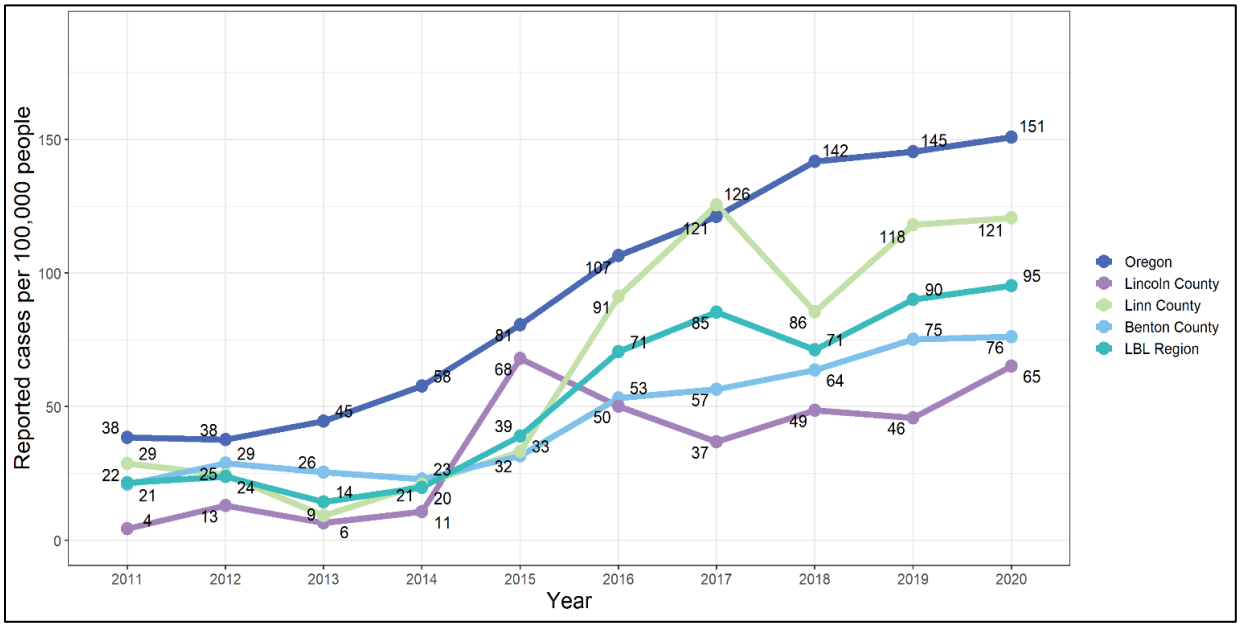
Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Figure 6-13: Reported cases of chlamydia per 100,000 people by year and location



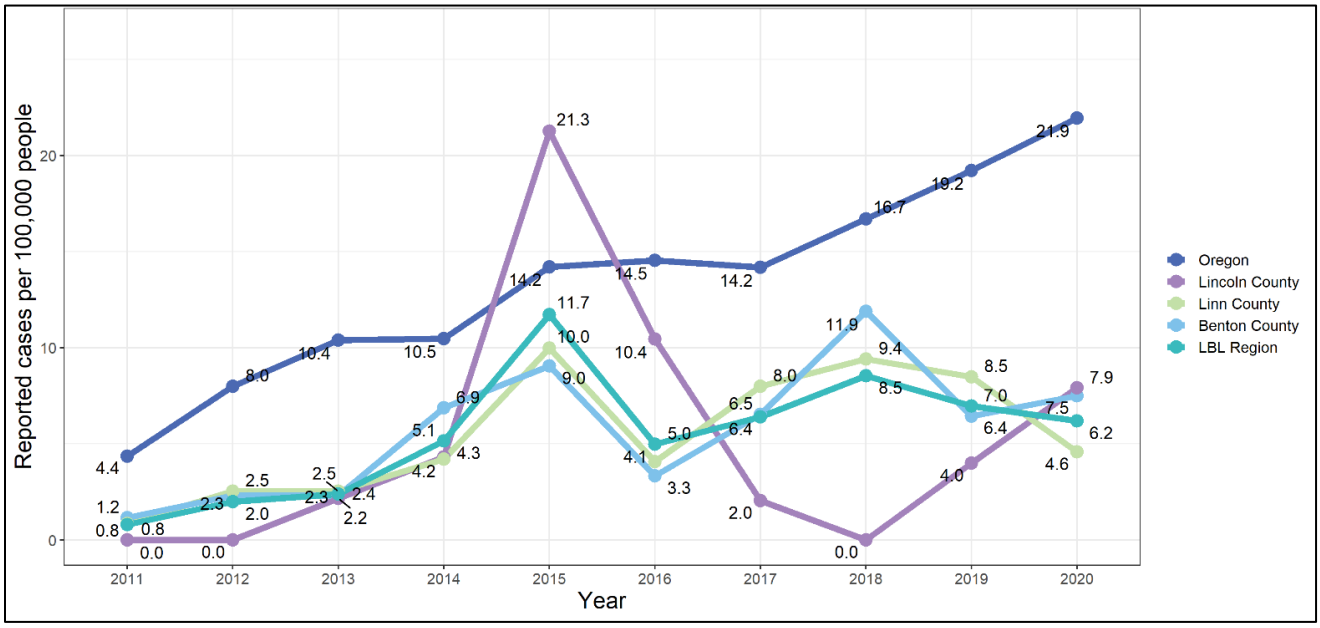
Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Figure 6-14: Reported cases of gonorrhea per 100,000 people by year and location



Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Figure 6-15: Reported cases of syphilis per 100,000 people by year and location



Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

7 Healthy Youth & Families

The wellbeing of gestational parents, infants, and children determines the health of the next generation and therefore is an important area for public health intervention. This section evaluates gestational parents and child health outcomes and numerous factors that influence these outcomes.

Throughout this section, we use the terms 'maternal' and 'women' as well as 'gestational parent' and 'pregnant parent.' We recognize that not all pregnant people identify as women. Often the choice of wording used in this report reflects the wording used by the data source being cited. We hope that inclusive language will become the standard in the future.

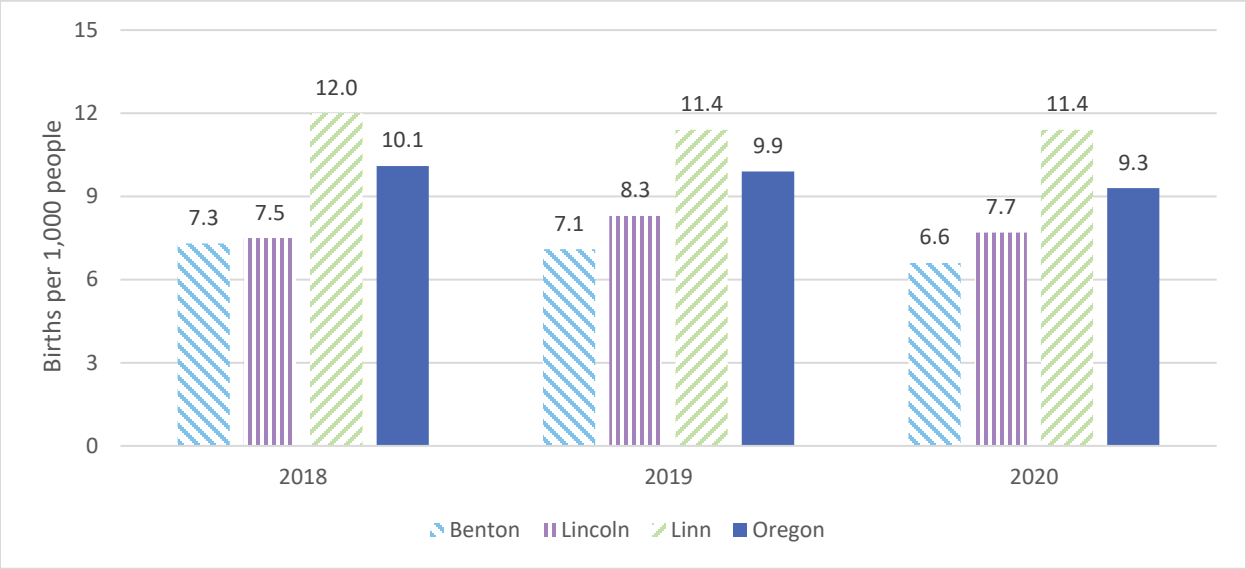
Pregnancy & Infant Health

Birth Rate

Birth rate is the total number of live births per 1,000 gestational parents each year. Overall, the birth rate in the LBL region decreased slightly from years 2018 to 2020. Linn County's birth rate is higher than that of Benton and Lincoln Counties and the state of Oregon (e.

Figure 7-1). Gestational parents in Benton County tend to give birth at a later age than gestational parents in Linn and Lincoln counties and the state of Oregon (Table 7-1). Gestational parents of Hispanic ethnicity had the highest birth rate.

Figure 7-1: Number of births per 1,000 people by year and location



Data source: Population data from Population Research Center, Portland State University; birth data from Vital Statistics, OHA Center for Health Statistics
Time period: 2018-2020
For more information: Population data: https://www.pdx.edu/population-research/population-estimate-reports, Birth data: https://www.oregon.gov/oha/PH/BIRTHDEATHCERTIFICATES/VITALSTATISTICS/BIRTH/Pages/index.aspx

Table 7-1: Number of births per 1,000 population by maternal age group and location

Maternal Age	Benton	Lincoln	Linn	Oregon
10 to 14 years	0	< 1	< 1	< 1
15 to 17 years	1	7	6	5
18 to 19 years	4	46	42	26
20 to 24 years	12	97	99	58
25 to 29 years	60	100	115	83
30 to 34 years	93	76	87	87
35 to 39 years	54	41	39	48
40 to 44 years	11	12	8	11
45 to 49 years	1	0	0	1

Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact local health department

Table 7-2: Number of births per 1,000 gestational parents by gestational parent's race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	28.1	37.8	35.2	35.6
Asian or Pacific Islander	24.7	36.2	35.6	36.9
Black	21.1	26.4	40.6	43.9
Hispanic	32.7	50.0	49.8	47.2
White	25.4	40.0	47.2	37.7

Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Prenatal Care and Healthy Pregnancy

Prenatal care is the health care a gestational parent receives during pregnancy. Prenatal care can help parents have a healthy pregnancy for themselves and their baby and can help identify and treat complications. Pregnant people who don't receive prenatal care are three times more likely to have babies born at a low birth weight and five times more likely to have babies that die than pregnant people who do get prenatal care.[56]

Adequate prenatal care is defined as care that began before the third trimester and included at least five prenatal care visits. Pregnant people who identify as White, non-Hispanic are more likely to receive adequate prenatal care than are other racial/ethnic groups. This is consistent across Linn, Benton, and Lincoln counties as well as the state (Table 7-3).

Access to prenatal care also varies by age. Teen parents (pregnancies among people under the age of 20) are less likely to receive adequate prenatal care than are other age groups. When compared to Oregon, the LBL region tends to have more gestational parents with adequate access to prenatal care, with the exception of gestational parents ages 35-49 (Table 7-4).

Table 7-3: Percent of pregnancies with inadequate or no prenatal care services by gestational parent's race/ethnicity and location

Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	20.0%	23.3%	14.5%	22.1%
Asian or Pacific Islander	11.2%	20.9%	18.6%	15.2%
Black	13.0%	23.3%	13.9%	19.6%
Hispanic	15.5%	17.5%	15.3%	16.3%
White	10.5%	14.1%	10.2%	11.3%

Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Table 7-4: Percent of pregnancies with inadequate or no prenatal care services by gestational parent's age group and location

Gestational Parent Age	Benton	Lincoln	Linn	Oregon
10 to 14 years	0.0%	0.0%	50.0%	48.0%
15 to 17 years	42.1%	17.2%	23.0%	26.4%
18 to 19 years	19.4%	24.5%	16.6%	21.3%
20 to 24 years	17.9%	18.2%	12.8%	17.6%
25 to 29 years	11.1%	14.3%	9.4%	12.8%
30 to 34 years	8.8%	12.2%	9.2%	10.0%
35 to 39 years	8.5%	13.9%	11.3%	9.8%
40 to 44 years	10.7%	17.8%	18.5%	12.5%
45 to 49 years	15.4%	20.0%	6.7%	11.1%

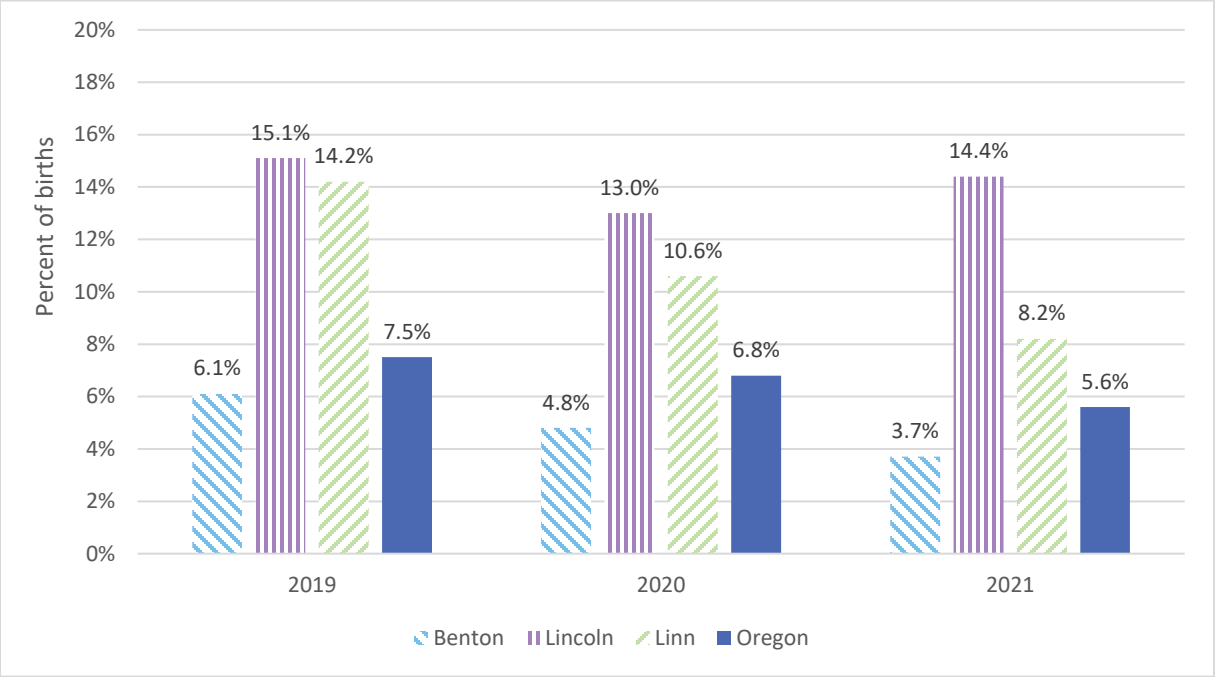
Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Prenatal Tobacco Use

Prenatal care includes an educational component in which the gestational parent can learn about behaviors that increase risk for complication such as tobacco use. Gestational parents who smoke are more likely to deliver their babies early, deliver low birth weight babies, and deliver babies with weaker lungs, increasing their risk for numerous health problems.[57]

From years 2018 to 2020, Lincoln County had the greatest percentage of births in which tobacco was used during pregnancy. Both Lincoln and Linn counties had rates of prenatal tobacco use far exceeding the Oregon state average during all three years (Figure 7-2). In the LBL region, younger gestational parents had higher rates of prenatal tobacco use (Table 7-5).

Figure 7-2: Percent of births in which tobacco was used during pregnancy by year and location



Data source: OHA Center for Health Statistics
Time period: 2019-2021
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/Oregonbirthsandpregnanciesbycounty/CountyDashboard

Table 7-5: Percent of maternal prenatal tobacco use by maternal age

Maternal Age	Benton	Lincoln	Linn	Oregon
10 to 14 years	0.0%	0.0%	50.0%	7.3%
15 to 17 years	7.9%	25.0%	23.2%	12.2%
18 to 19 years	21.9%	26.5%	26.7%	16.5%
20 to 24 years	14%	24.2%	21.2%	15.4%
25 to 29 years	7.1%	17.6%	14.3%	10.1%
30 to 34 years	4.2%	15.7%	10.8%	6.3%
35 to 39 years	3.6%	12.3%	11.8%	5.0%
40 to 44 years	4.4%	10.2%	9.8%	4.7%
45 to 49 years	0.0%	20.0%	0.0%	2.3%

Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

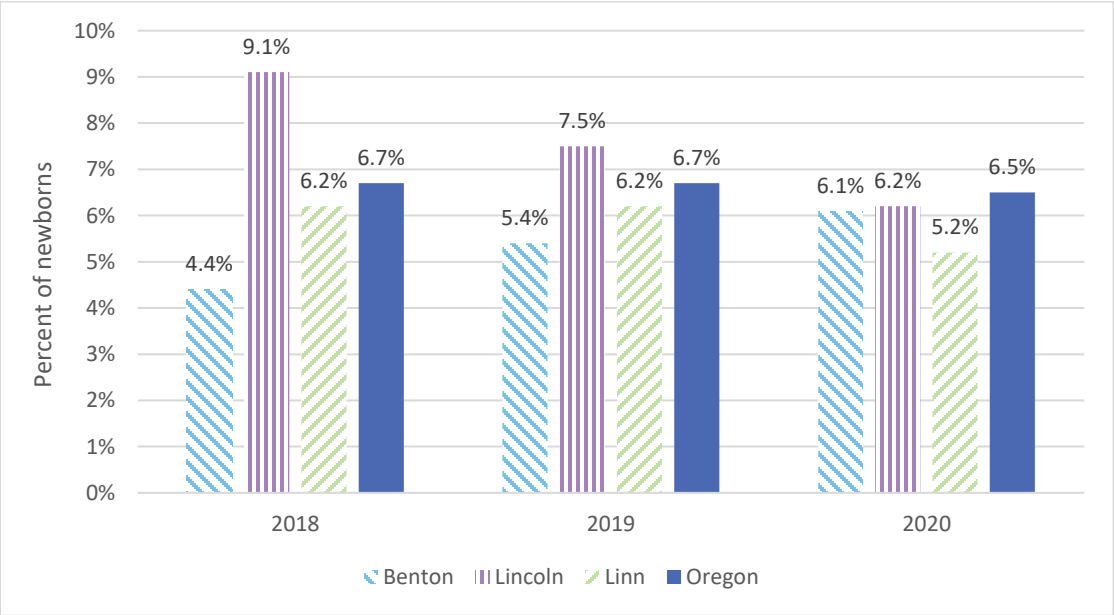
Premature Birth and Low Birthweight

Infant weight at birth is a strong predictor of health outcomes including chances of survival, risk of medical complications, and achievement of development milestones.[58] Low birthweight can be caused by numerous factors including premature birth, infection during pregnancy, smoking, and alcohol or drug use.

Low birthweight is defined as an infant whose weight at birth is 5.5 pounds or less. Lincoln County had the greatest percentage of low birthweight births from 2018 to 2020, although its rates have decreased drastically during this time period. Benton County's percentage of low birthweight births were below the Oregon state average for years 2018 to 2020 but its rates did increase during this time period (Figure 7-2).

Teen gestational parents (ages 10-19) and gestational parents of advanced gestational parent age (ages 35-49) have the highest percentage of newborns with low birthweight (Table 7-5). This may be in part driven by the region's rates of premature birth, which also exceed those of Oregon and follow a similar pattern when looking at gestational parent age. Premature birth is defined as birth that occurs before the 37th week of pregnancy. Black gestational parents are much more likely to both have a newborn with low birthweight and to experience premature birth (Table 7-6).

Figure 7-3: Percent of newborns with low birthweight by year and location



Data source: OHA Center for Health Statistics
Time period: 2018-2020
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/VitalStatistics/birth/Pages/index.aspx

Table 7-6: Percent of newborns with low birthweight by maternal age group and location

Maternal Age	Benton	Lincoln	Linn	Oregon
10 to 14 years	0.0%	33.3%	0.0%	4.6%
15 to 17 years	7.9%	9.4%	10.2%	8.4%
18 to 19 years	9.0%	10.8%	7.5%	7.7%
20 to 24 years	6.4%	6.4%	6.4%	6.7%
25 to 29 years	5.1%	6.0%	5.4%	5.8%
30 to 34 years	4.3%	7.4%	5.4%	6.1%
35 to 39 years	6.0%	12.1%	8.1%	7.1%
40 to 44 years	10.2%	6.8%	10.9%	9.1%
45 to 49 years	15.4%	0.0%	20.0%	15.0%

Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Table 7-7: Percent of newborns with low birthweight by gestational parent's race/ethnicity and location

Gestational Parent Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	7.3%	8.3%	5.8%	7.5%
Asian or Pacific Islander	4.9%	7.0%	6.0%	7.8%
Black	11.7%	10.0%	10.2%	9.8%
Hispanic	6.6%	7.9%	6.3%	6.6%
White	5.1%	7.3%	6.1%	6.1%

Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact county health department

Table 7-8: Percent of premature births by gestational parent's age group and location

Gestational Parent Age	Benton	Lincoln	Linn	Oregon
10 to 14 years	0.0%	33.3%	0.0%	8.6%
15 to 17 years	5.3%	12.5%	9.7%	8.9%
18 to 19 years	11.6%	9.3%	8.8%	8.2%
20 to 24 years	5.9%	5.9%	7.7%	7.7%
25 to 29 years	5.9%	8.0%	6.9%	7.1%
30 to 34 years	5.4%	8.7%	7.4%	7.5%
35 to 39 years	7.2%	12.7%	10.8%	8.9%
40 to 44 years	10.3%	7.6%	13.4%	11.4%
45 to 49 years	38.5%	20.0%	46.7%	18.8%

Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

Table 7-9: Percent of premature births by gestational parent's race/ethnicity and location

Gestational Parent Race/Ethnicity	Benton	Lincoln	Linn	Oregon
American Indian or Alaska Native	10.9%	5.2%	7.5%	10.0%
Asian or Pacific Islander	4.9%	8.1%	4.7%	7.9%
Black	14.3%	10.0%	11.1%	9.7%
Hispanic	7.4%	9.5%	8.2%	8.2%
White	6.0%	8.3%	7.8%	7.5%

Data source: Oregon Public Health Assessment Tool
Time period: 2011-2020
For more information: contact the local health department

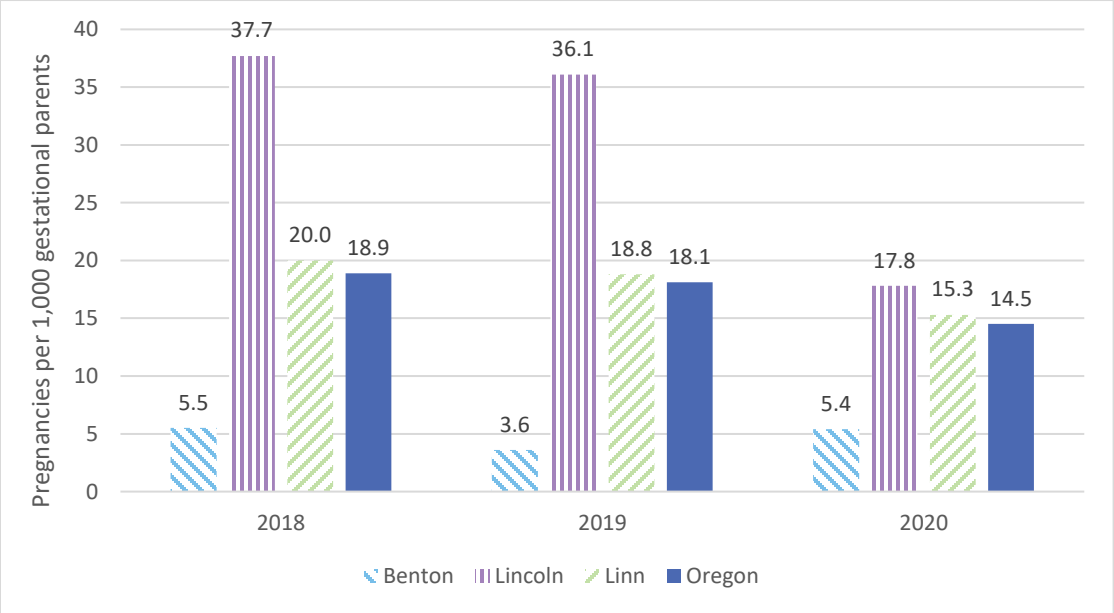
Teen Pregnancy

Teen pregnancy and childbearing have long-term social and economic costs on teen parents and their children. Only about 50% of teen gestational parents receive a high school diploma by age 22 compared to 90% of gestational parents who don't have children as a teen. The children of teenage gestational parents are more likely to drop out of high school themselves, have low academic achievement, have more health problems, be incarcerated as an adolescent, give birth during their teenage years, and face

unemployment as a young adult.[59] These long-term costs make teen pregnancy a pertinent public health issue.

In the United States, rates of teen pregnancy have been declining since 1991. On average, in the LBL region, teen pregnancy rates have been declining from years 2018 to 2020. Lincoln County experienced disproportionately high rates of teen pregnancy in years 2018 and 2019 but has seen a major reduction in rates of teen pregnancy in the year 2020. Linn County's rates of teen pregnancy are similar to those of the state of Oregon, while Benton County's teen pregnancy rates are lower (Figure 7-3).

Figure 7-4: Teen pregnancy rate by location, 2018-2020



Data source: Population Research Center, Portland State University
Time period: 2018-2020
For more information:
https://www.oregon.gov/oha/PH/BIRTHDEATHCERTIFICATES/VITALSTATISTICS/TEENPREGNANCY/Pages/Teen-Pregnancy-YTD-and-Final.aspx

Breastfeeding

Breastfeeding has health benefits for both babies and gestational parents. Breast milk is the best source of nutrition for most babies and thanks to antibodies shared from gestational parent to baby through breast milk, breastfeeding can protect babies from some short and long-term illnesses and diseases. Breastfed babies have lower risk of asthma, obesity, type 1 diabetes, sudden infant death syndrome, ear infections, and stomach bugs. Breastfeeding can reduce gestational parent's risk of breast and ovarian cancer, type 2 diabetes, and high blood pressure.[60]

Data on breastfeeding are limited at both the state and county level. However, state programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), give some insight into the percentage of participating gestational parents who breastfeed. In 2021, Lincoln County had the greatest percentage of pregnant gestational parents on WIC and the greatest percentage of gestational

parents who started out breastfeeding. After 6 months however, Lincoln County WIC gestational parents are the least likely to have exclusively breastfed. Benton County had the greatest percentage of gestational parents who breastfed exclusively for 6 months in 2021 (Table 7-10).

Table 7-10: Percent of gestational parents who utilized WIC during the postpartum period by breastfeeding duration and location

	Benton	Lincoln	Linn
Percent of WIC gestational parents who started out breastfeeding (initiation)	97%	99%	93%
Percent of gestational parents who breastfed exclusively for 6 months	43%	33%	39%

Data source: 2021 WIC Annual Report, Oregon Health Authority
Time period: 2021
For more information: https://www.oregon.gov/oha/PH/HEALTHYPEOPLEFAMILIES/WIC/Pages/annual.aspx

Child and Adolescent Health

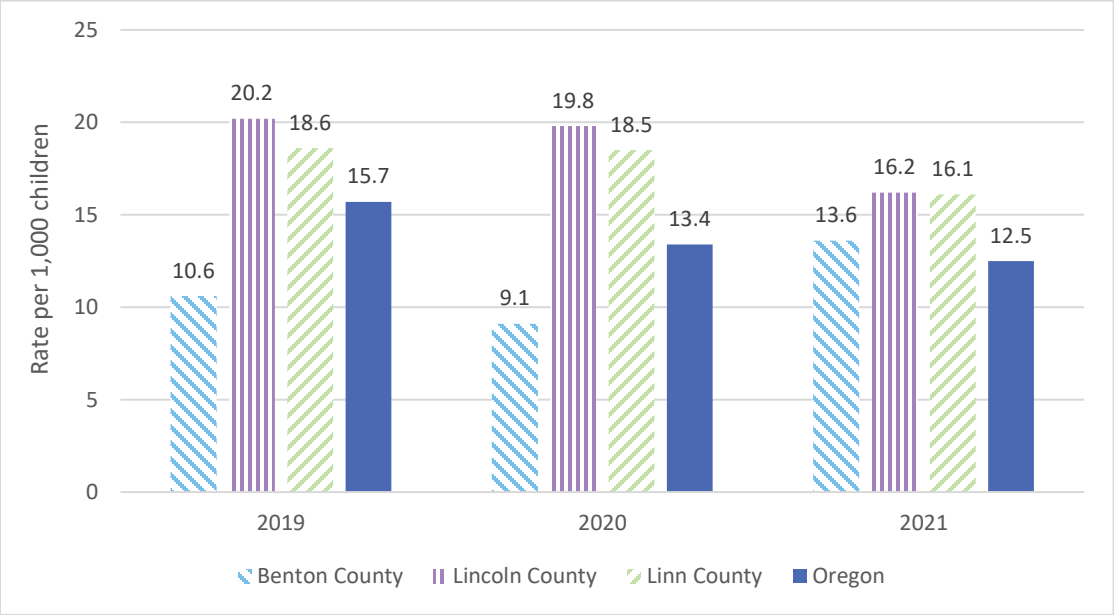
Childhood and adolescence are formative times in a person's life, and they set the stage for later health and wellbeing. The number and severity of adverse experiences during childhood affect an individuals' risk for alcoholism, depression, heart disease, liver disease, intimate partner violence, sexually transmitted infections, smoking, and suicide. Child and adolescent health include overall health and wellness involving child abuse, foster care, and youth immunization rates.

Child Abuse

Child abuse is one form of Adverse Childhood Experience (ACE). In 2021 there were a total of 5,576 reports of child abuse in the LBL region. Of those reports, 3,098 (53.6%) were referred to Child Protective Services. In 2021, neglect and threat of harm were the two most common forms of child abuse in the LBL region. In Oregon, leading family stress factors of abused children are substance use, domestic violence, and parental involvement with law enforcement.

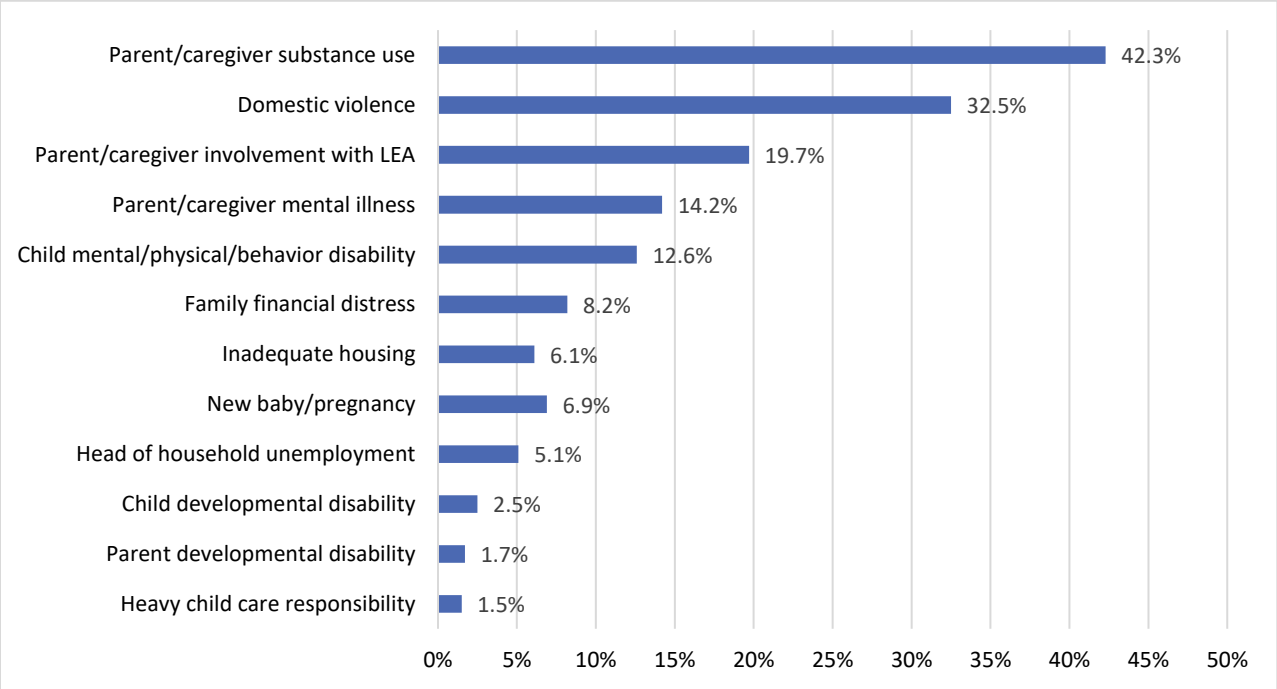
Lincoln and Linn counties had higher rates of child abuse compared to Benton County and the state of Oregon during years 2019 to 2021. Child abuse rates dropped in both Linn and Lincoln counties between 2019 and 2021, however did increase by 4.5% in Benton County from 2020 to 2021 (Figure 7-5). From 2019 to 2021, Lincoln County had many more children in foster care per 1,000 children than did Benton and Linn counties and the state of Oregon (Figure 7-7).

Figure 7-5: Number of child abuse victims per 1,000 children by location



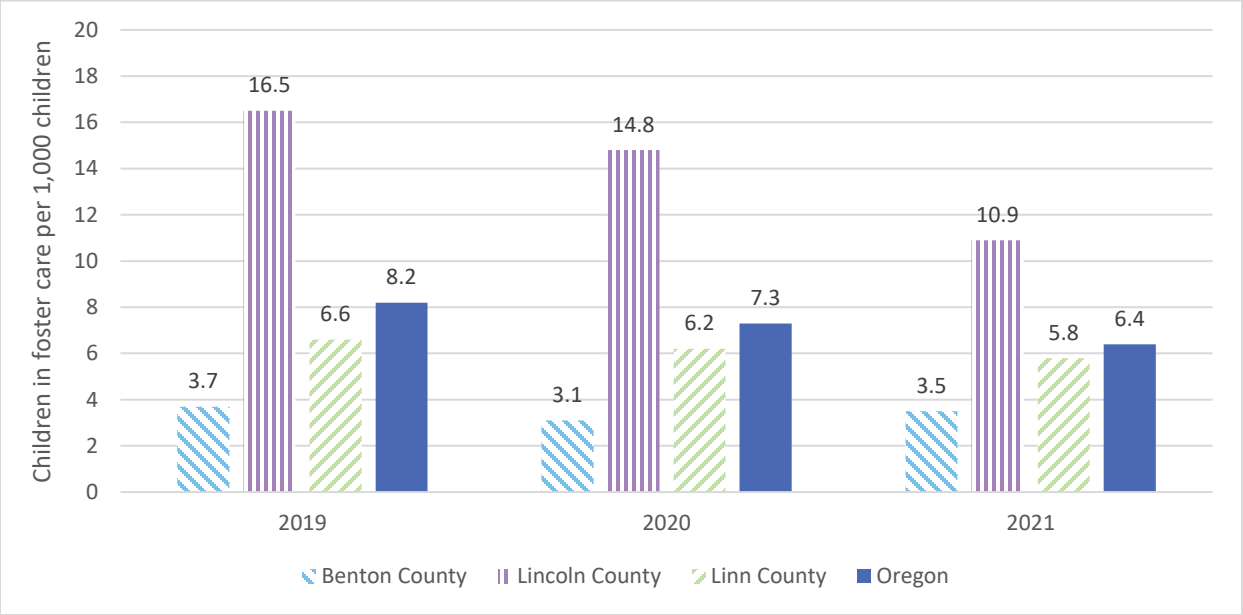
Data source: Child Welfare Data Book
Time period: 2019-2021
For more information: https://www.oregon.gov/dhs/CHILDREN/CHILD-ABUSE/Documents/2021-cw-data-book.pdf

Figure 7-6: Family stress factors among founded abuse cases, Oregon



Data source: Child Welfare Data Book
Time period: 2021
For more information: https://www.oregon.gov/dhs/CHILDREN/CHILD-ABUSE/Documents/2021-cw-data-book.pdf

Figure 7-7: Number of children in foster care per 1,000 children by location



Data source: Child Welfare Data Book
Time period: 2019-2021
For more information: https://www.oregon.gov/dhs/CHILDREN/CHILD-ABUSE/Documents/2021-cw-data-book.pdf

Youth Immunization Rates

Immunization against communicable diseases has been one of the greatest advancements in public health and has led to the elimination of numerous diseases in the United States including smallpox, polio, measles, and rubella. Each year, childhood vaccines save an estimated two to three million lives worldwide.[61]

The current Centers for Disease Control and Prevention (CDC) recommendations (as of 2022) are for children to be fully vaccinated by age two against:

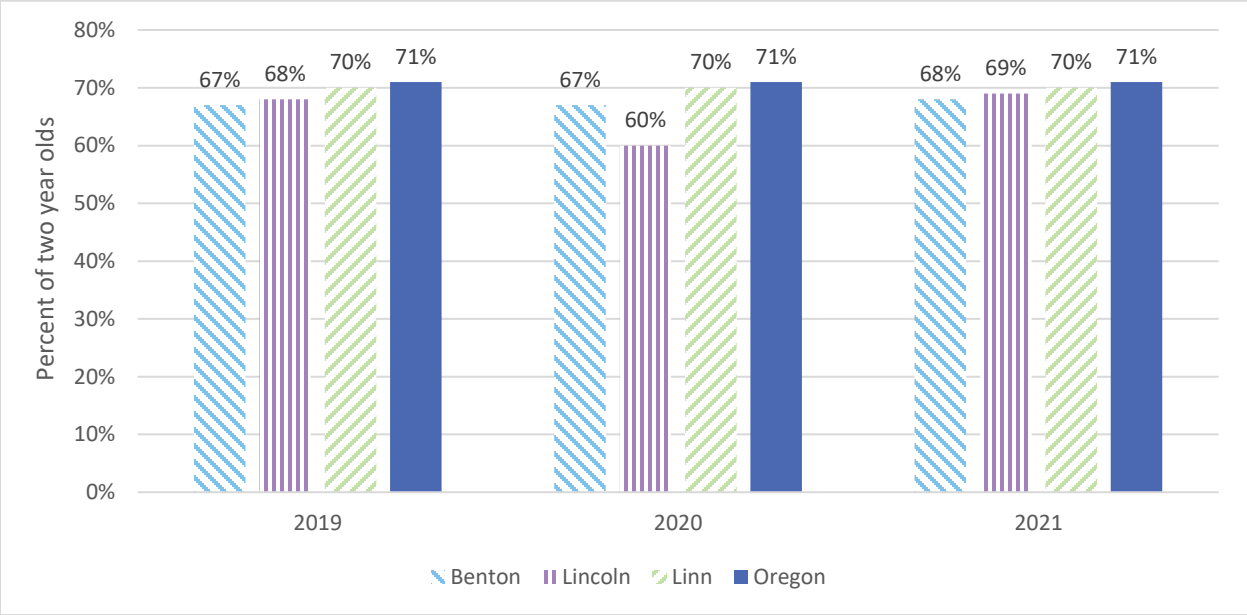
- Diphtheria, Tetanus, Pertussis
- Polio
- Measles, Mumps, Rubella
- Hib (a bacterial infection that can cause meningitis)
- Hepatitis B
- Varicella (Chickenpox)
- Pneumococcal conjugate

This is known as the 4:3:1:3:3:1:4 schedule. When compared to the state of Oregon, the LBL region had lower percentages of two year olds up to date with this vaccine schedule during years 2019 through 2021 (Figure 7-8). In years 2019 and 2021, the counties making up the LBL region had similar percentages of two year olds who completed the 4:3:1:3:3:1:4 vaccine schedule. In 2020, Lincoln County's percentage of two year olds who completed the 4:3:1:3:3:1:4 vaccine schedule declined, possibly due to COVID-19 healthcare interruptions.

Vaccination rates vary slightly among WIC clients. In 2019-2021, fewer two year olds enrolled in WIC services completed the 4:3:1:3:3:1:4 vaccine schedule in Benton and Linn counties when compared to the general population. In Lincoln County during these years, a greater or equal percentage of two year olds enrolled in WIC services completed the 4:3:1:3:3:1:4 vaccine schedule than the general population.

Starting at age 11 or 12, adolescents are recommended to receive Tdap, HPV, and Meningococcal vaccines. In 2021, adolescents in the LBL region received the Tdap vaccine at rates comparable to the state average. Adolescents in the LBL region received the Meningococcal and HPV vaccine at rates slightly lower than the state average in 2021 (Table 7-11).

Figure 7-8: Percent of two-year olds up to date with the 4:3:1:3:3:1:4 vaccine series by location



Data source: ALERT Immunization Information System (IIS)
Time period: 2019-2021
For more information:
https://www.oregon.gov/oha/ph/preventionwellness/vaccinesimmunization/pages/researchchild.aspx

Table 7-11: Percent of adolescents ages 13 to 17 immunized for specific diseases by location

	Benton	Lincoln	Linn	Oregon
Tdap (tetanus, diphtheria, acellular pertussis)	89%	87%	92%	90%
Meningococcal	75%	72%	76%	81%
HPV completion (2 or 3 doses depending on age at first dose)	50%	48%	44%	55%

Data source: Alert Immunization Information System (IIS)
Time period: 2021
For more information:
https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/VACCINESIMMUNIZATION/Pages/researchteen.aspx

8 Mental & Behavioral Health

The term "behavioral health" refers to a wide range of topics and is often used interchangeably with "mental health." Behavioral health describes the connection between a person's behaviors and the health and wellbeing of the body and mind,[62] while mental health refers only to one's emotional, psychological and social wellbeing.[63] This chapter explores topics that fall under the categorization of mental health and those that are categorized as behavioral health including substance use, nutrition and physical activity.

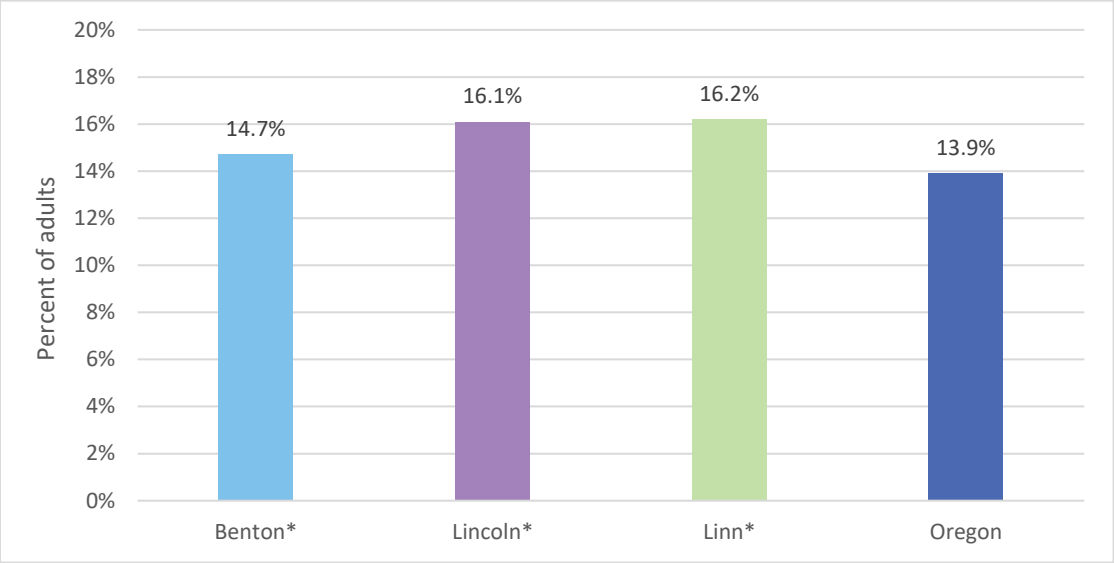
Mental Health

Mental health has a significant impact on overall health and is composed of emotional, psychological, and social factors. Poor mental health reduces one's ability to cope with stress, make healthy decisions, and recover from disease. The association between poor mental health and chronic disease has been well established in literature. Oregon has a considerably high prevalence of mental health illness and low access to mental health care. In 2020, Oregon ranked last in the United States for mental health.[64] Given the extreme burden of this public health issue, the 2020-2024 State Health Improvement Plan aims to improve behavioral health and reduce mental health stigma in Oregon communities.[65]

Based on PLACES estimates, a greater number of adults in the LBL region experienced 14 or more "not good" mental health days when compared to Oregon on average (Figure 8-1). Mental illness differs from poor mental health. A mental illness is a diagnosed condition that affects one's thoughts and behaviors. According to the CDC, more than 50% of Americans will be diagnosed with a mental illness in their lifetime. In 2020, 21.8% of Oregon's population had a diagnosis of depression.[66] PLACES estimates show the LBL region as having similar rates of depression as the state of Oregon, with Linn and Lincoln counties having slightly higher rates and Benton County having slightly lower rates (Figure 8-2). Benton County consistently outperformed the surrounding counties in regard to mental health indicators. From 2018-2020, Lincoln County had the highest rates of suicide deaths in the LBL region. The majority of suicide deaths in the LBL region were among those ages 25-44 (Figure 8-6).

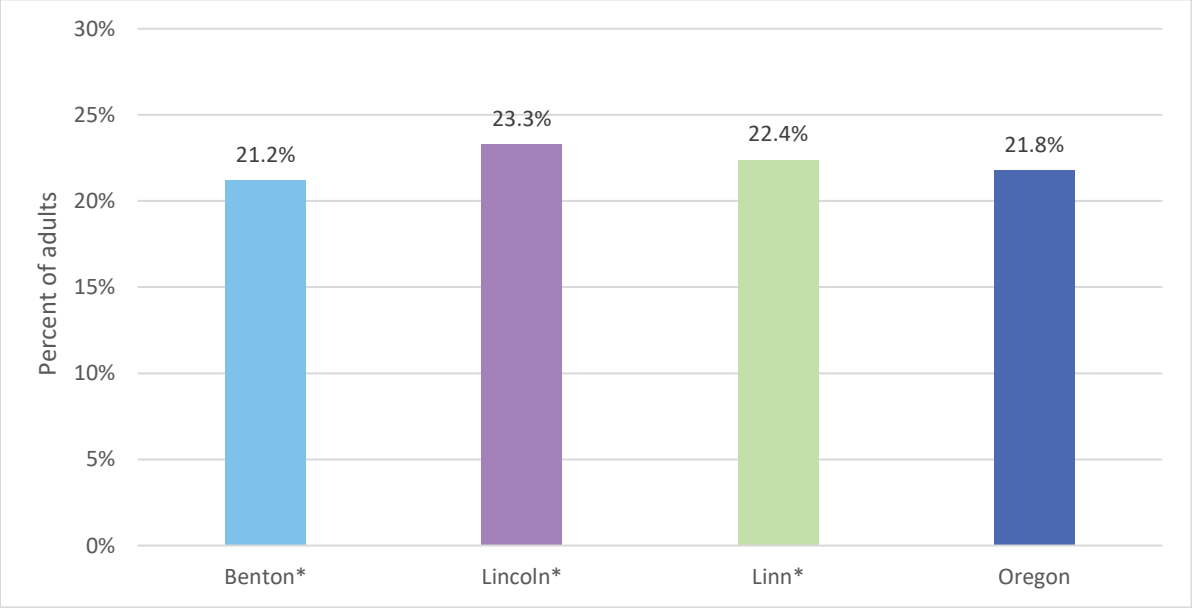
Mental health in adolescents and children is a growing problem that had been exacerbated by the COVID-19 pandemic. In the 2021 student health survey, 37% of surveyed high school students reported having poor mental health during the pandemic and 44% felt persistently sad or hopeless over the previous year.[67] To track health indicators in the adolescent population, the Oregon Health Authority administers the Oregon Healthy Teens Survey to eighth and eleventh graders across the state during in odd numbered years. In 2019, students residing in Lincoln County had a high prevalence of feeling sad and hopeless (Figure 8-3) and ranked consistently poor for other important mental health indicators. Close to a quarter of all eighth graders in Lincoln County reporting seriously considering suicide (Figure 8-7) and over 13% of the students reported attempting suicide (Figure 8-8). Lincoln County also had the highest percentage of eleventh graders who considered suicide, however eleventh grade students in Linn County more commonly reported attempting suicide. Benton County students had the lowest percentage of suicidal ideation and attempts in the region (Figures 8-7 and 8-8).

Figure 8-1: Age adjusted percent of adults who experienced 14 or more "not good" mental health days by location



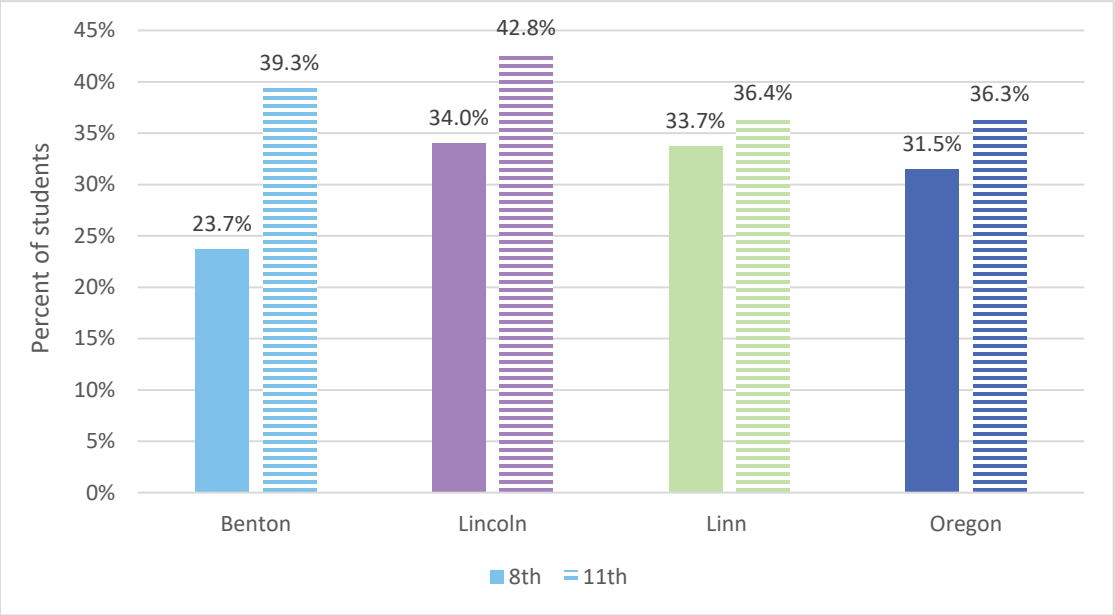
**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*
Data source: Behavioral Risk Factor Surveillance System PLACES
Time period: 2020
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Figure 8-2: Age adjusted percent of adults that report being diagnosed with depression by location



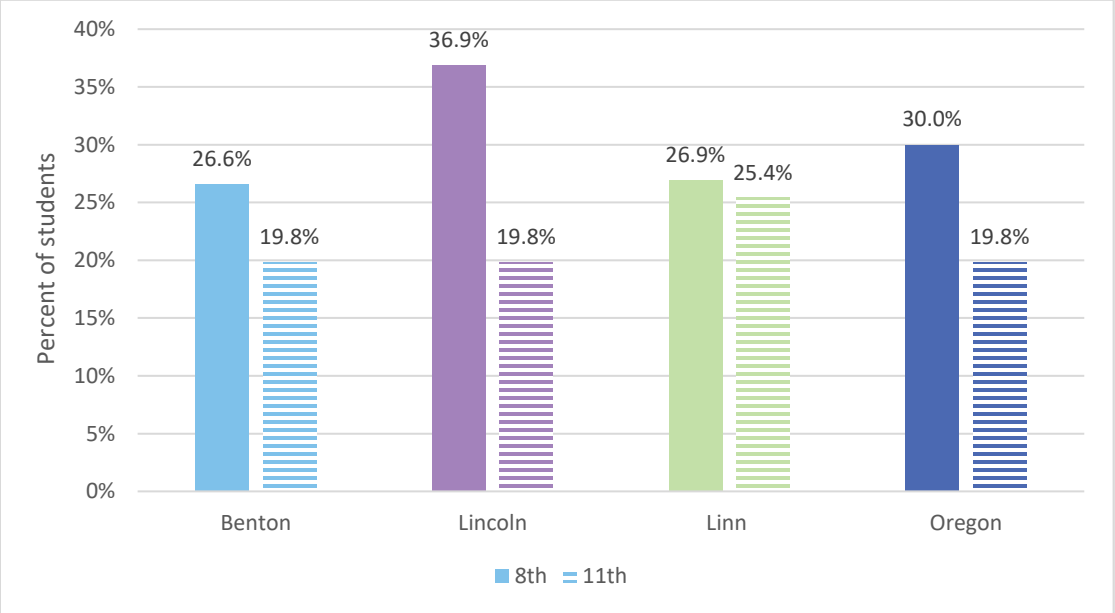
**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*
Data source: Behavioral Risk Factor Surveillance System PLACES
Time period: 2020
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Figure 8-3: Percent of students who reported feeling sad or hopeless almost every day for 2+ weeks in a row by grade and location



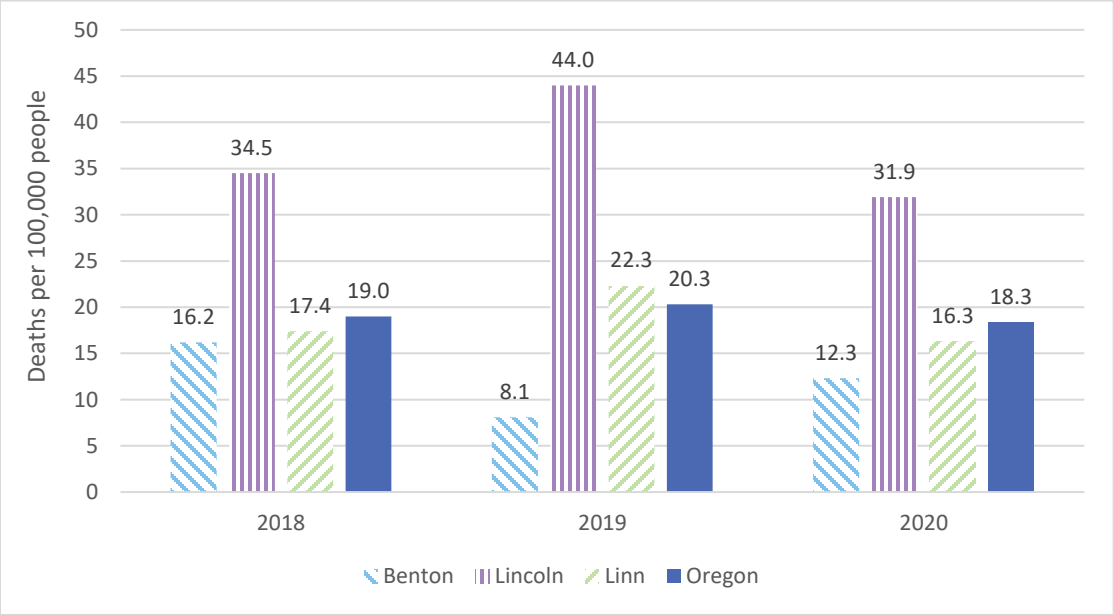
Data source: Oregon Healthy Teen Survey
Time period: 2019
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/Surveys/OregonHealthyTeens/Pages/index.aspx

Figure 8-4: Percent of students who reported being bullied at school in the last 30 days by grade and location



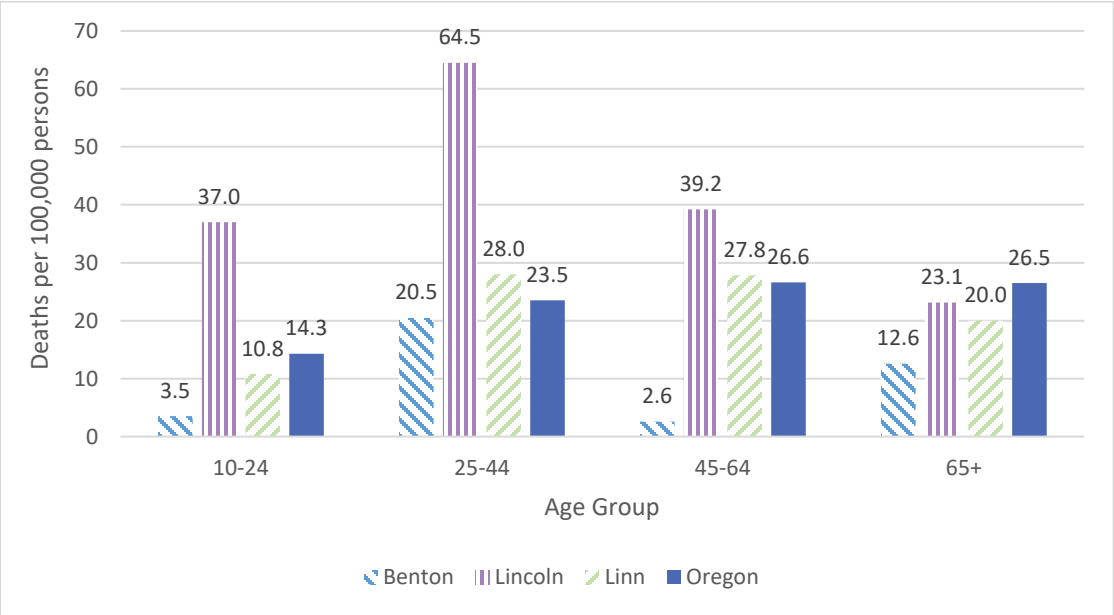
Data source: Oregon Healthy Teen Survey
Time period: 2019
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/Surveys/OregonHealthyTeens/Pages/index.aspx

Figure 8-5: Age adjusted number of deaths by suicide per 100,000 people by year and location



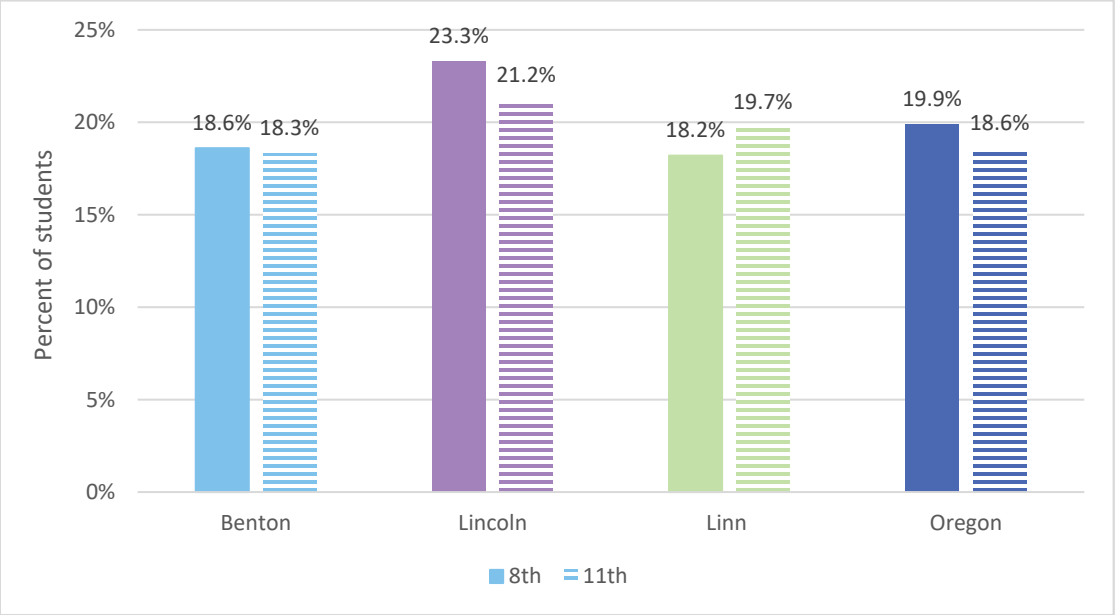
Data source: Oregon Violent Death Dashboard
Time period: 2018-2020
For more information: https://www.oregon.gov/oha/PH/DiseasesConditions/InjuryFatalityData/Pages/nvdrs.aspx

Figure 8-6: Number of deaths by suicide per 100,000 people by age group and location



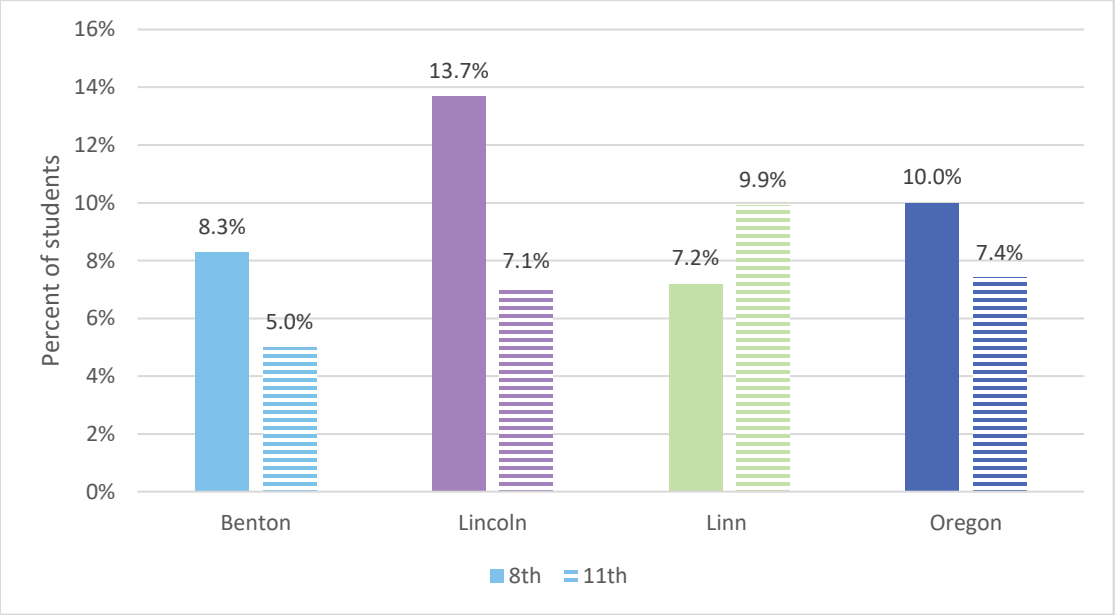
Data source: Oregon Violent Death Dashboard
Time period: 2019-2020
For more information: https://www.oregon.gov/oha/PH/DiseasesConditions/InjuryFatalityData/Pages/nvdrs.aspx

Figure 8-7: Percent of students who reported seriously considering attempting suicide by grade and location



Data source: Oregon Healthy Teen Survey
Time period: 2019
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/Surveys/OregonHealthyTeens/Pages/index.aspx

Figure 8-8: Percent of students who reported attempting suicide by grade and location



Data source: Oregon Healthy Teen Survey
Time period: 2019
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/Surveys/OregonHealthyTeens/Pages/index.aspx

Substance Use

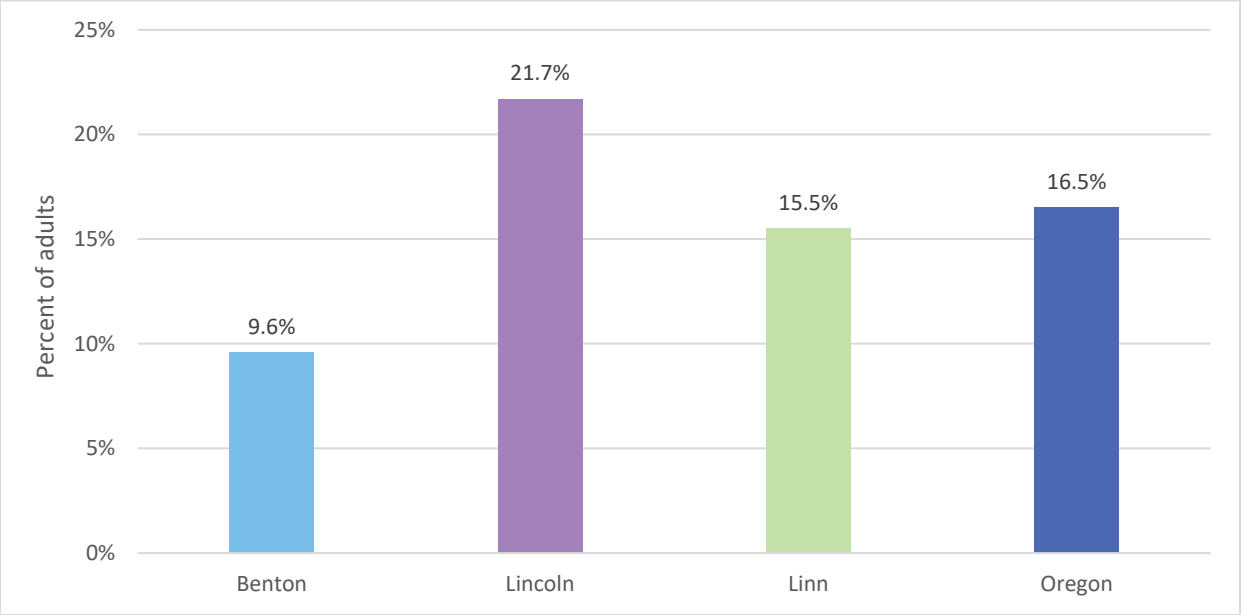
The dangers of tobacco use are well documented and include heightened risk for a myriad of diseases including cancer, heart disease, stroke, lung disease, diabetes, and chronic obstructive pulmonary disease.[68] For every person who dies because of smoking, at least 30 people live with a serious smoking-related illness. In 2020, 18.8% of Oregon residents living with one or more chronic diseases smoked cigarettes.[69] Lincoln County has the highest percent of adults who smoke cigarettes and a higher percentage than Oregon on average (Figure 8-9). Of those who smoke cigarettes in the LBL region, over half either want to quit smoking or have attempted to quit during the previous year (Table 8-1).

Alcohol and prescription medications are consumed appropriately and responsibly by most of the population. However, problems frequently occur when these substances are overconsumed, used inappropriately, combined with other substances, or consumed while engaging in risky activities such as driving or unsafe sexual activity. PLACES estimates show a greater percentage of Linn and Lincoln County adults engaging in binge drinking than the Oregon average (Figure 8-10). Binge drinking is defined as five or more drinks among men and four or more drinks among women per day.

Drug overdose deaths in the LBL region in years 2017 to 2019 were driven primarily by opioids and methamphetamine. The majority of Linn County's drug overdose deaths during these years were from methamphetamines while the majority of Benton and Lincoln County drug overdoses were from opioids.[70] In years 2017 and 2018, all counties belonging to the LBL region experienced fewer accidental/undetermined drug overdose deaths per 100,00 people than the state of Oregon. In 2019, drug overdose rates increased in all three counties and the state of Oregon (Figure 8-11). From 2018 to 2019, Lincoln County's drug overdose death rate increased 147%.

Misuse of substances at an early age (particularly before age 18) is shown to be an important predictor of substance use disorders later in life, making this period an important focus for prevention efforts. In 2019, Lincoln County had the greatest percentage of 8th grade students who had ever used cigarettes, alcohol, marijuana, and prescription drugs (Figure 8-12). Among 11th graders that same year, Linn County had the greatest percent of students who had ever used cigarettes, alcohol, marijuana, and e-cigarettes. In 2019, 37.4% of Linn County's 11th graders reported ever having used an e-cigarette (Figure 8-13). This is much higher than use in Lincoln and Benton counties and the state of Oregon.

Figure 8-9: Percent of adults 18 years and older who smoke cigarettes by location



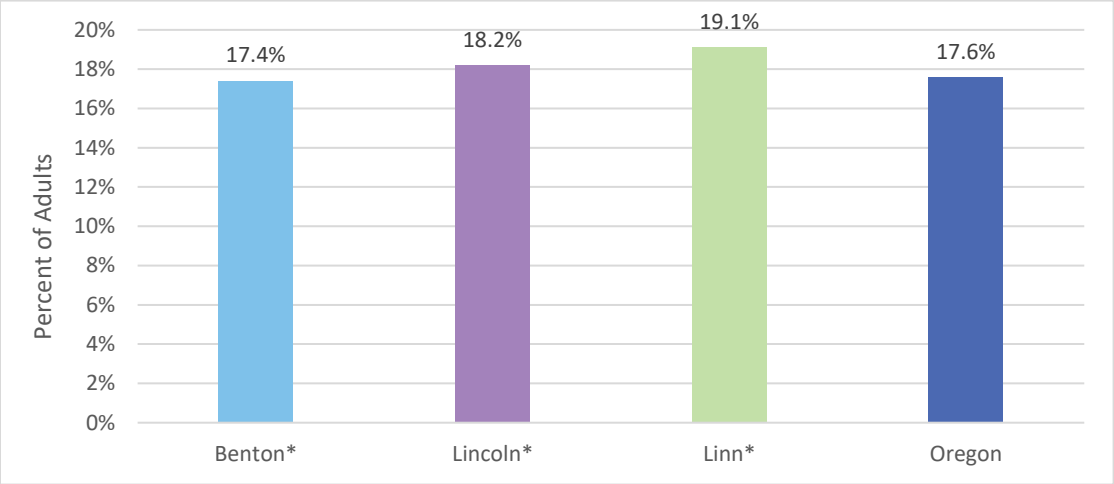
Data source: Oregon Behavioral Risk Factor Surveillance System County Combined dataset, 2016 –2019
Time period: 2016-2019
For more information: https://www.oregon.gov/oha/ph/preventionwellness/tobaccoprevention/pages/oregon-tobacco-facts.aspx

Table 8-1: Percent of adult smokers by quit status and location

	Benton	Lincoln	Linn	Oregon
Wants to quit cigarette smoking	55.9%	53.2%	59.5%	63.2%
Attempted to quit cigarette smoking during the previous year	51.9%	57.8%	51.0%	54.1%

Data source: Oregon Behavioral Risk Factor Surveillance System County Combined dataset, 2016 –2019
Time period: 2016-2019
For more information: https://www.oregon.gov/oha/ph/preventionwellness/tobaccoprevention/pages/oregon-tobacco-facts.aspx

Figure 8-10: Percent of adults 18 years and older who binge drink by location



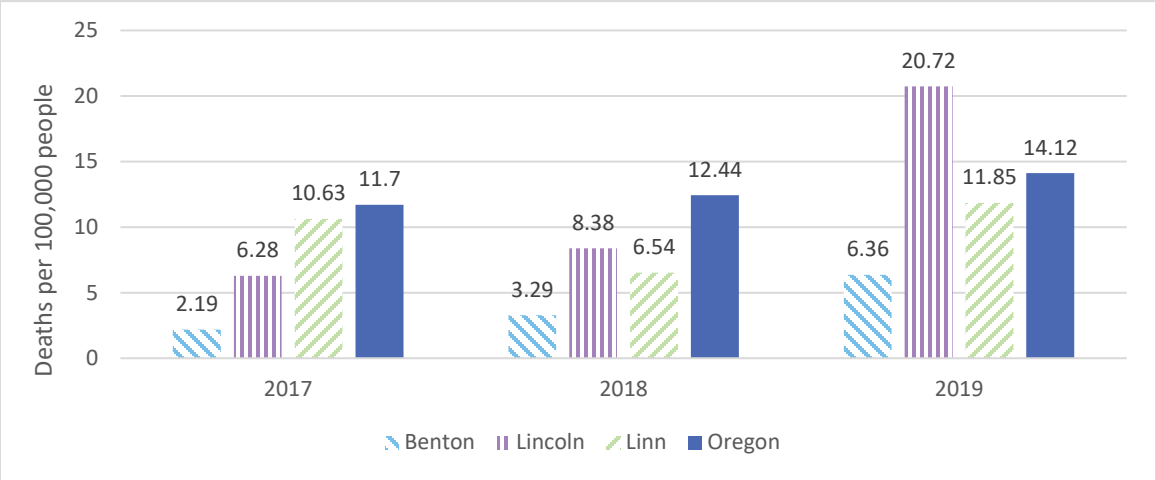
**Note: Calculated via small area estimation methods using all national 2020 BRFS survey responses statistically adjusted for county-level demographics.*

Data source: Behavioral Risk Factor Surveillance System PLACES

Time period: 2020

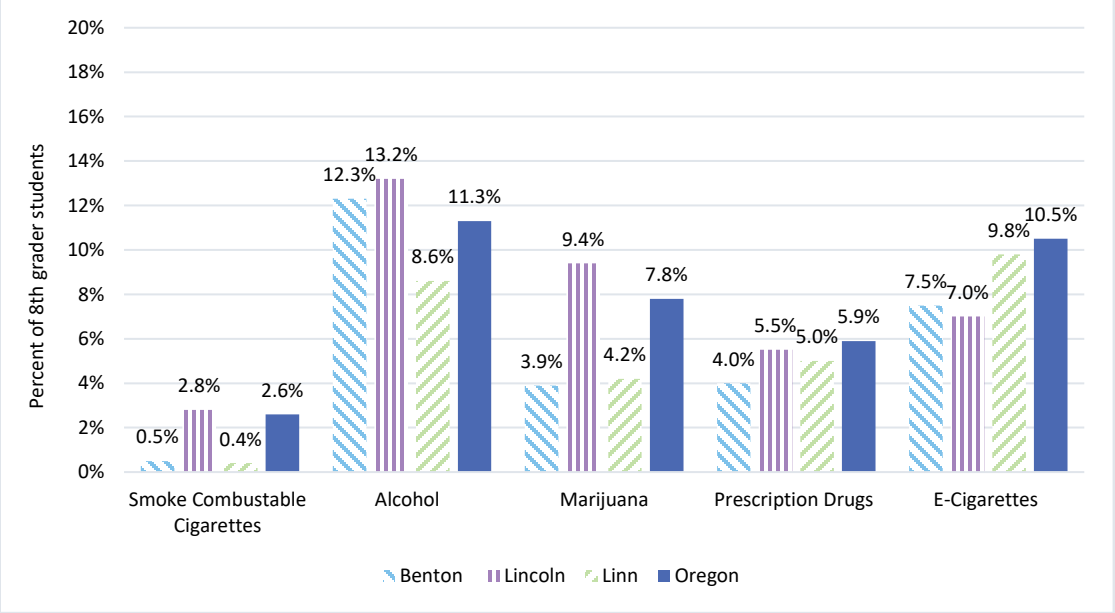
For more information: County-level data: https://www.cdc.gov/places/index.html. State-level data here: https://www.cdc.gov/brfss/brfssprevalence/index.html

Figure 8-11: Number of accidental/undetermined deaths from drug overdose per 100,000 people by year and location



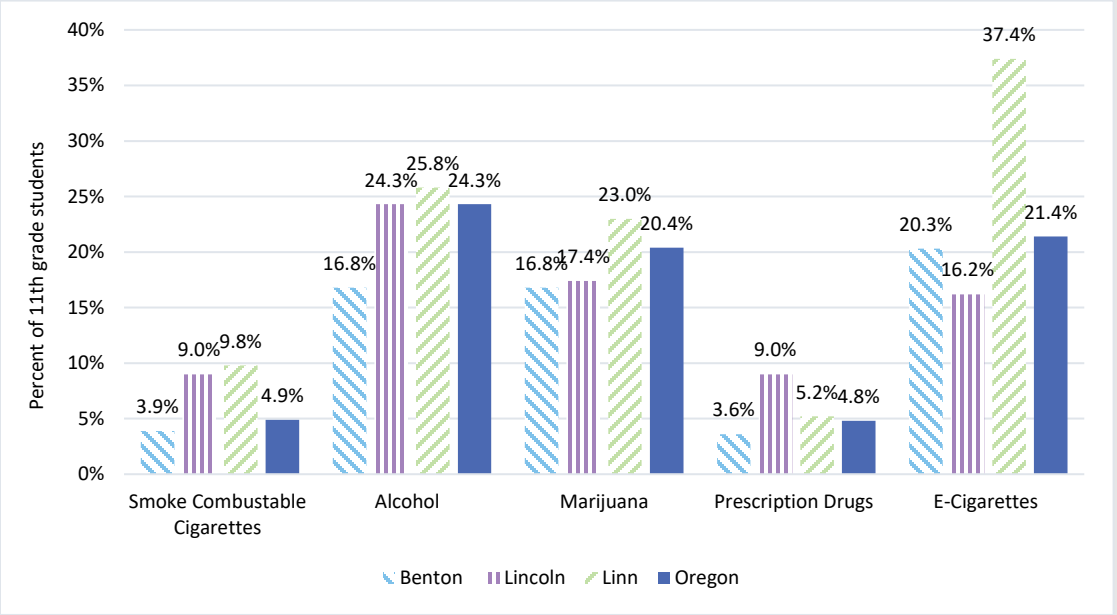
Data source: Oregon Prescribing Drug Overdose Data Dashboard
Time Period: 2017-2019
For more information:
https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/SUBSTANCEUSE/OPIOIDS/Pages/data.aspx

Figure 8-12: Percent of 8th grade students who reported ever using substances by substance and location



Data source: Oregon Healthy Teen Survey
Time period: 2019
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/Surveys/OregonHealthyTeens/Pages/index.aspx

Figure 8-13: Percent of 11th grade students who reported ever using substances by substance and location



Data source: Oregon Healthy Teen Survey
Time period: 2019
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/Surveys/OregonHealthyTeens/Pages/index.aspx

Nutrition & Physical Activity

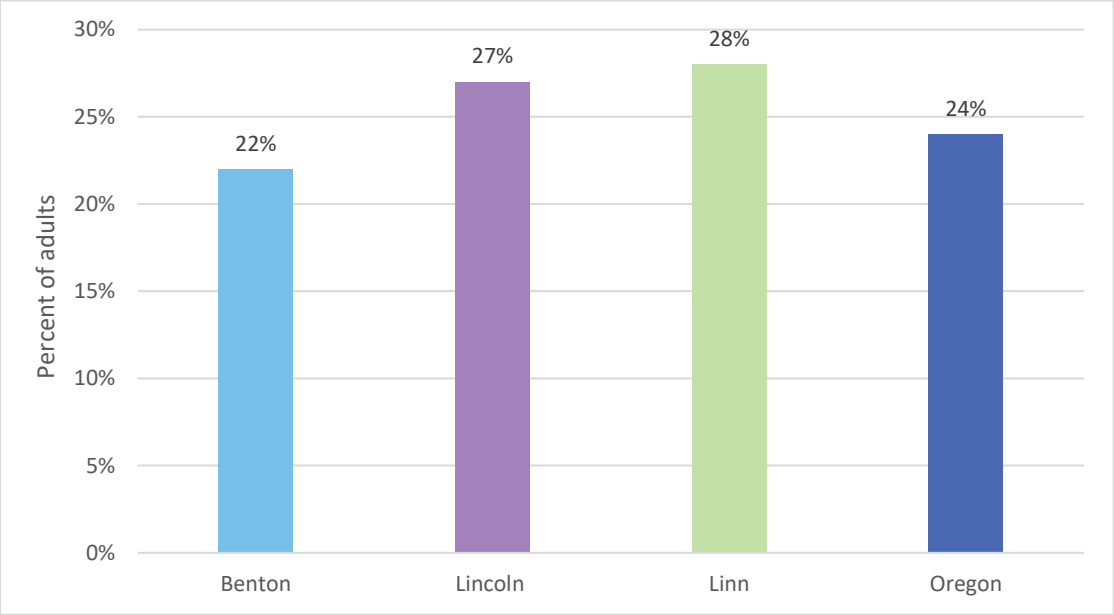
Healthy nutrition and physical activity promote lifelong health through improvement in body composition, musculoskeletal health, physical and cognitive health, and prevention of chronic disease.[71] However, the ability to make healthy choices related to nutrition and physical activity is greatly constrained by the characteristics of one's community and life circumstances (see Chapter 4: Social Determinants of Health.)

Physical inactivity is associated with several diseases and conditions, including type 2 diabetes, cancer, stroke, hypertension, cardiovascular disease, and premature mortality. The United States Department of Health and Human Services (DHHS) recommends that adults get at least 150 minutes of moderate-intensity physical activity per week, 75 minutes of vigorous-intensity physical activity per week, or a combination of both moderate-to-vigorous physical activity.[72] Leisure-time physical activity is physical activity that occurs outside of work hours and is often used as a population-level measure of physical activity. In 2019, a greater percentage of adults in Linn and Lincoln counties engaged in no leisure-time physical activity compared to the state of Oregon (Figure 8-14).

The DHHS recommends that adolescents get 60 minutes or more of physical activity every day.[73] In 2019, the percent of students meeting this recommendation was much lower among 11th graders than among 8th graders in both Linn and Benton counties. Lincoln County had the greatest percentage of 11th graders engaged in at least 60 minutes of physical activity a day in the LBL region, while Linn County had the greatest percentage of 8th graders meeting the guidelines in the LBL region.

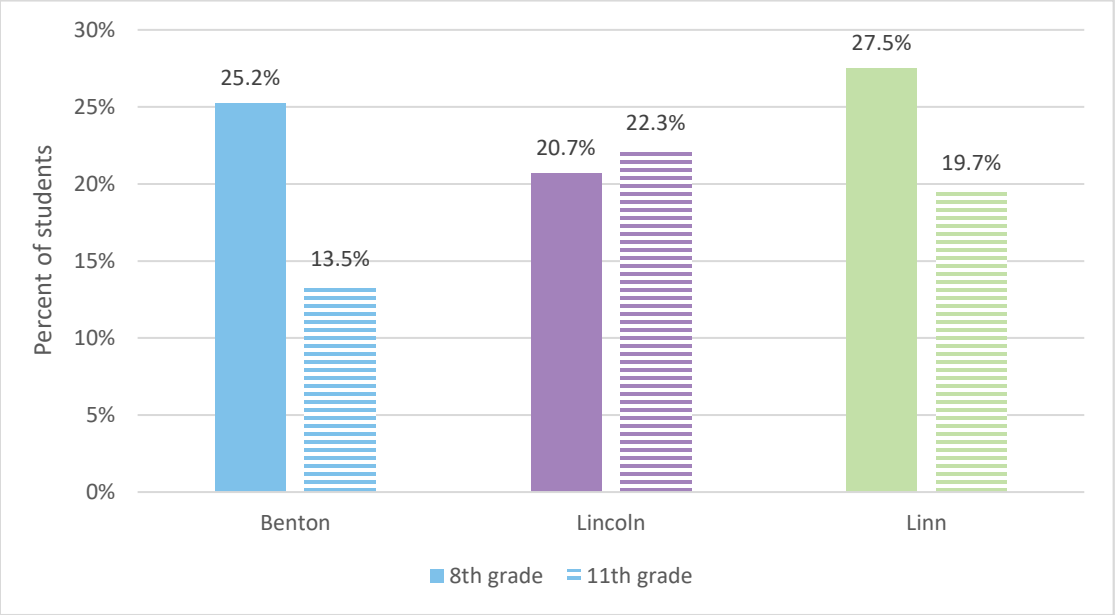
Eighth graders in the LBL region were more likely to consume five or more servings of fruits and vegetables per day than were 11th graders. Benton County had the greatest percentage of both 8th and 11th grade students who consumed five or more servings of fruits or vegetables per day in 2019. This is consistent with data that shows that Benton County residents have the greatest access to grocery stores (Figure 3-4).

Figure 8-14: Age-adjusted percent of adults 18 and over reporting no leisure-time physical activity in the past month by location



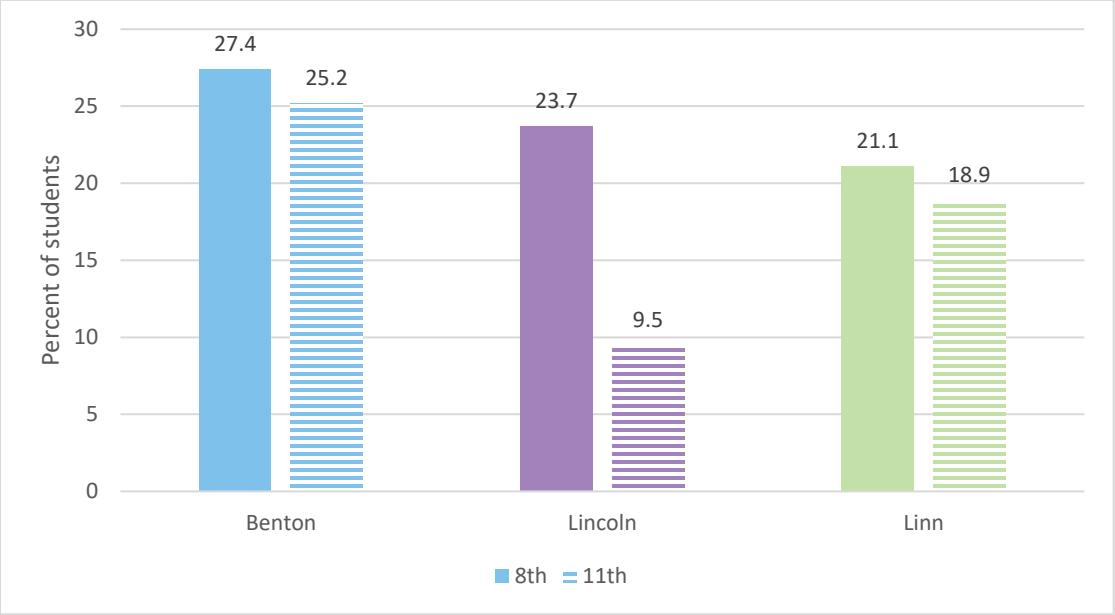
Data source: County Health Rankings
Time period: 2022
For more information: https://www.countyhealthrankings.org/explore-health-rankings/county-health-rankings-model/health-factors/health-behaviors/diet-and-exercise/physical-inactivity?state=41&year=2022#map-anchor

Figure 8-15: Percent of students who are physically active for at least 60 minutes per day by grade and location



Data source: Oregon Healthy Teen Survey
Time period: 2019
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/Surveys/OregonHealthyTeens/Pages/index.aspx

Figure 8-16: Percent of students who consume 5 or more servings of fruits and vegetables per day by grade and location



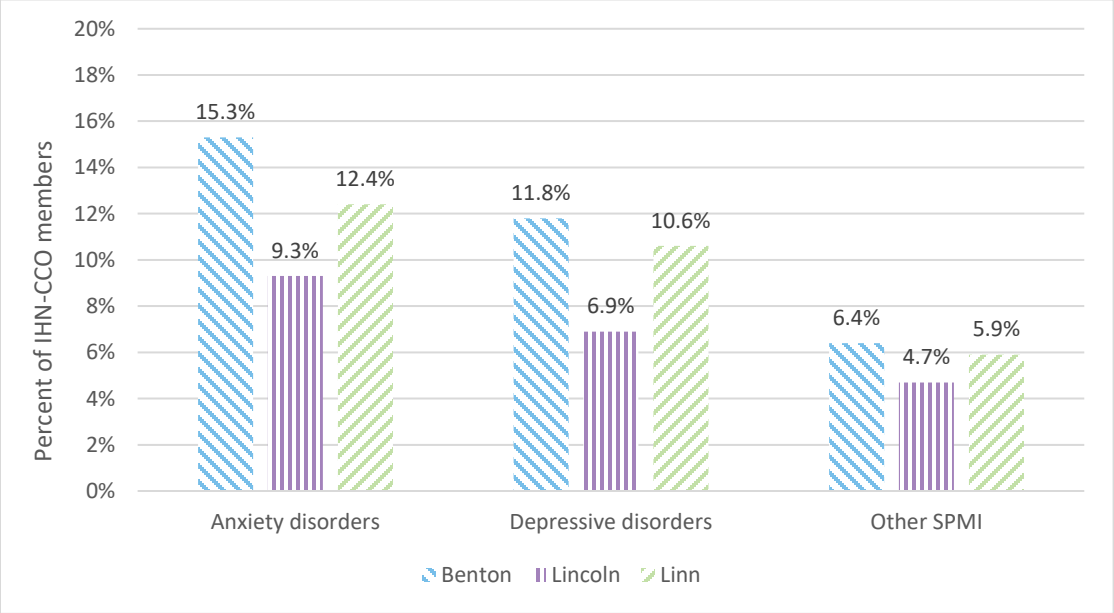
Data source: Oregon Healthy Teen Survey
Time period: 2019
For more information:
https://www.oregon.gov/oha/PH/BirthDeathCertificates/Surveys/OregonHealthyTeens/Pages/index.aspx

Oregon Health Plan (Medicaid): InterCommunity Health Network Coordinated Care Organization (IHN-CCO)

The Oregon Health Plan (OHP) is Oregon's Medicaid program. The Oregon Health Authority established a network of Coordinated Care Organizations (CCOs) as Medicaid managed care organizations to coordinate services for people covered by the Oregon Health Plan. The InterCommunity Health Network Coordinated Care Organization (IHN-CCO), established in 2012, is responsible for managing care for OHP members in the LBL region. Nationally, Medicaid recipients are disproportionately affected by mental health disorders and Medicaid is the largest payer for mental health services in the United States.[74] In 2021, 12.4% of all IHN-CCO members were diagnosed with an anxiety disorder and 10.6% had been diagnosed with depression (Figure 8-17). Over 70% of IHN-CCO members with a serious and persistent mental illness received at least one outpatient behavioral health visits in 2021, with persons residing in Lincoln County most likely to receive care (Figure 8-18).

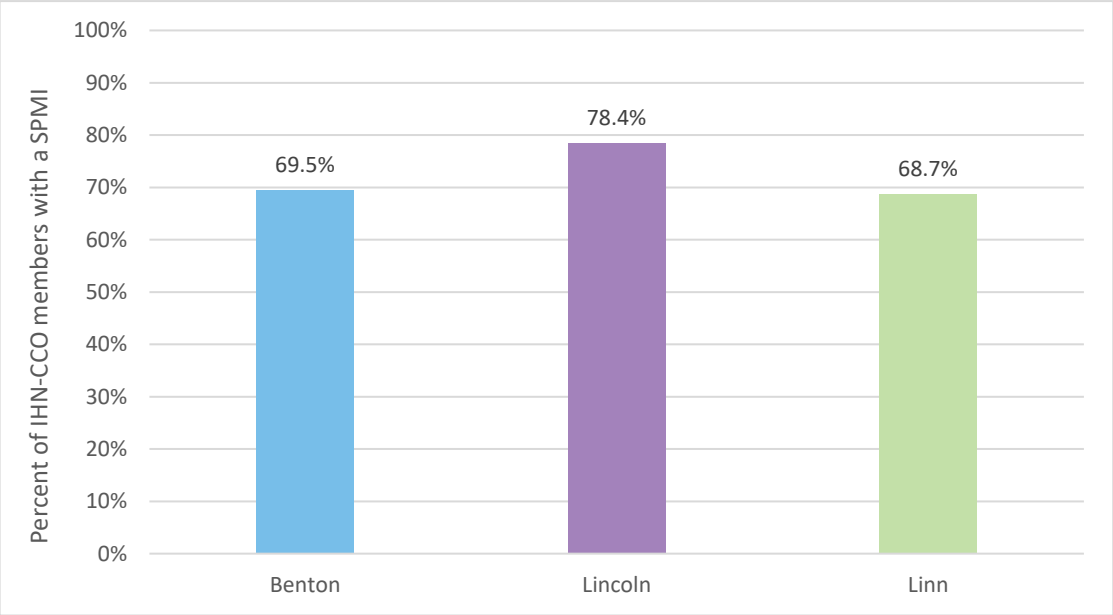
It is important to note that the data below come from insurance claims. Claims are only available for health care services that were provided – meaning that individuals both sought care and were able to access care. The data below should be interpreted as a reflection of the services provided, not a reflection of the total need or frequency of health conditions among IHN-CCO members.

Figure 8-17: Percent of IHN-CCO members with a serious and persistent mental illness (SPMI)* diagnosis, by type and location



**SPMI, as defined by OHA, includes Schizophrenia; Major depressive disorder; Bipolar disorder; Anxiety, limited to obsessive compulsive disorder (OCD) or post traumatic stress disorder (PTSD); Schizotypal personality disorder; Borderline personality disorder*[75]
Data source: IHN-CCO claims
Time period: 2021
For more information: email SHSresearch@samhealth.org

Figure 8-18: Percent of IHN-CCO members with a serious and persistent mental illness (SPMI)* who had an outpatient behavioral health visit by location



**SPMI, as defined by OHA, includes Schizophrenia; Major depressive disorder; Bipolar disorder; Anxiety, limited to obsessive compulsive disorder (OCD) or post traumatic stress disorder (PTSD); Schizotypal personality disorder; Borderline personality disorder*[76]

Data source: IHN-CCO claims

Time period: 2021

For more information: email SHSresearch@samhealth.org

9 COVID-19

The COVID-19 pandemic has taken over a million lives in the United States as of May 31, 2022.[77] Of those, 7,635 were Oregonians, and 402 lived in Linn, Benton, and Lincoln counties.[78] Almost 750,000 Oregonians have had a confirmed case of COVID-19, which represents about 18% of the population in 2022. The burden of the pandemic has landed heavily on diverse populations, low-income groups, and the elderly. This chapter focuses on the disease itself, but the broader community effects, including education, mental health, economic distress, food insecurity, racism, and the effect on the health care system cannot be ignored. These effects are still being investigated and may take years to be fully revealed and understood.

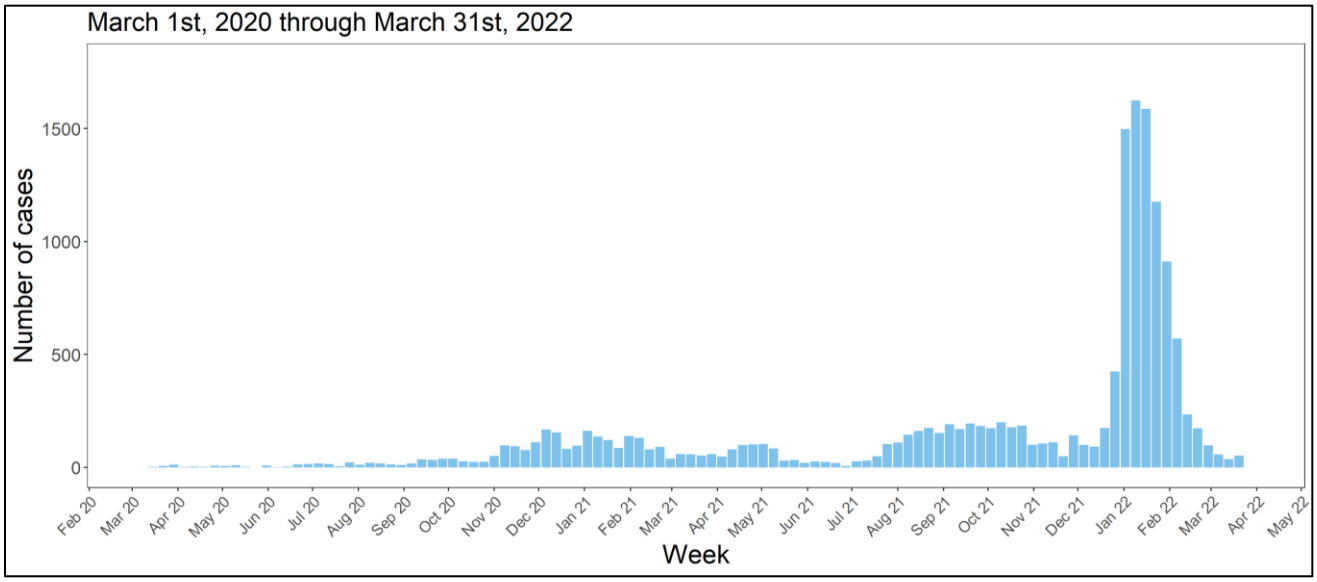
There are likely many cases of COVID-19 that have never been reported to public health authorities; therefore, all case rate data should be understood as reported cases only. However, in most cases hospitalizations and deaths that were caused by COVID-19 were accurately reported to public health, so those data are highly accurate.

Case Rates

The first recorded case of COVID-19 in Oregon was diagnosed on February 28, 2020 in Washington County.[79] Since that date, there have been over 50,000 diagnosed cases of COVID-19 in Linn, Benton, and Lincoln counties. The cases have come in waves as environmental conditions and emerging variants have sparked new surges. The following graphs show the number of reported cases each week from the beginning of the pandemic until March 2022. Linn County experienced the greatest number of COVID-19 cases in the LBL region, followed by Benton County (Figures 9-1, 9-2, and 9-3).

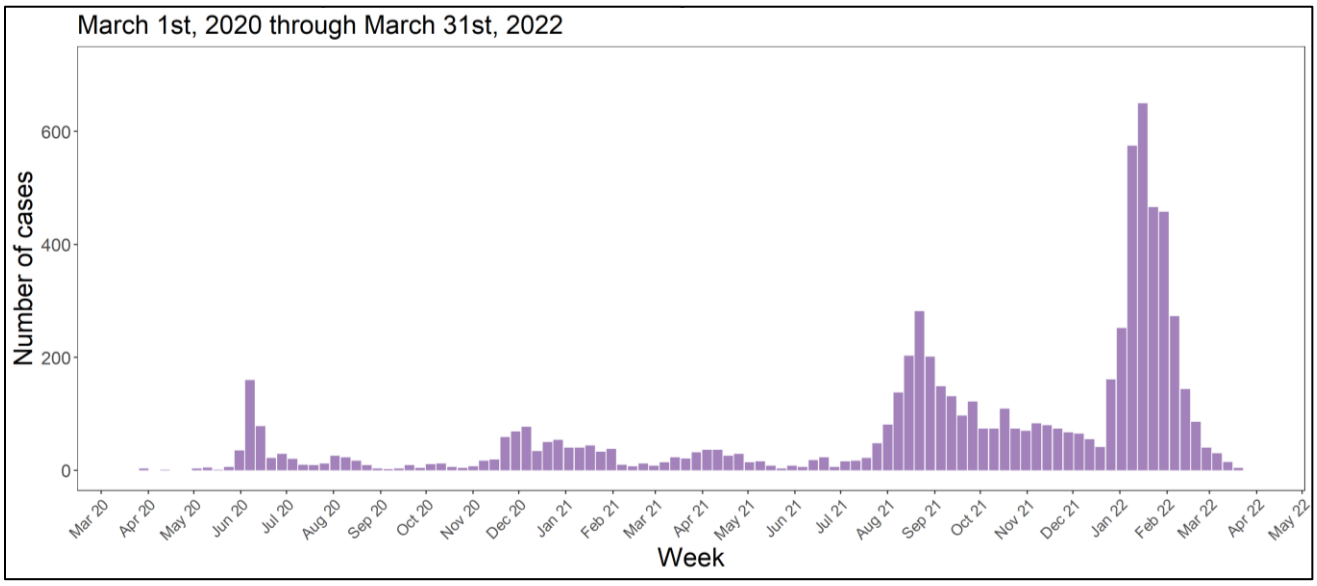
The disease dynamics are similar in all three counties. Lincoln County experienced a major outbreak at a seafood processing plant in June 2020, which explains the spike in cases during that month. The significant surges in August 2021 and January 2022 were caused by the Delta and Omicron variants, respectively.

Figure 9-1: Number of newly confirmed COVID-19 cases in Benton County by date



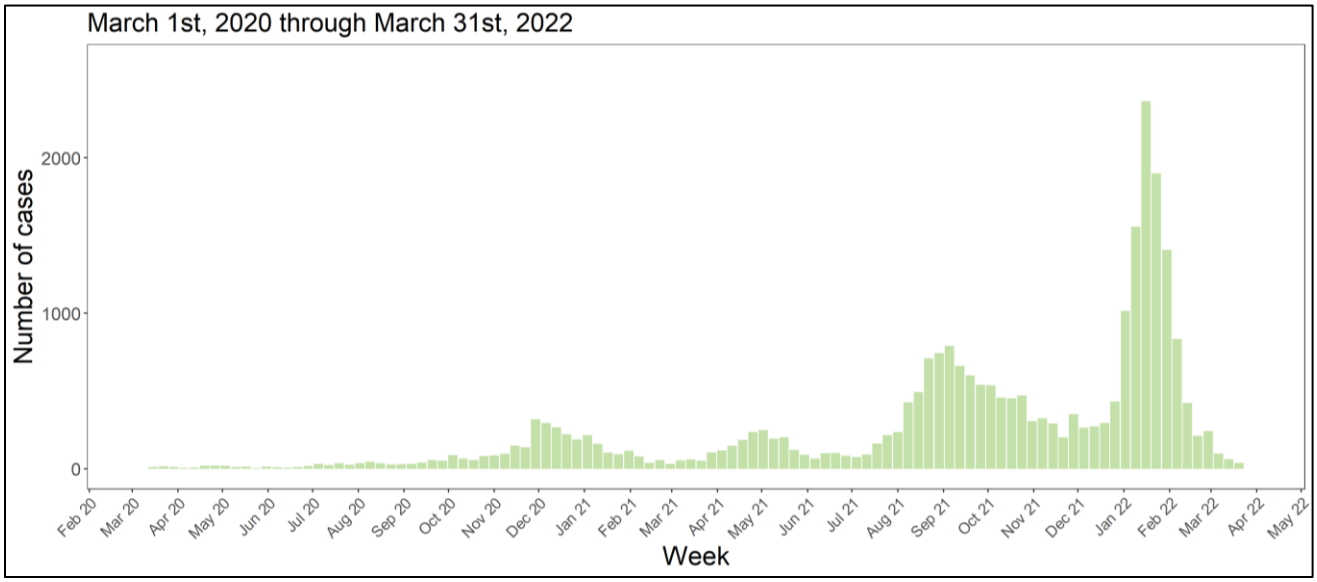
Data source: OPERA
Time period: 2020-2022
For more information: contact county health department

Figure 9-2: Number of newly confirmed COVID-19 cases in Lincoln County by date



Data source: OPERA
Time period: 2020-2022
For more information: contact county health department

Figure 9-3: Number of newly confirmed COVID-19 cases in Linn County by date



Data source: OPERA
Time period: 2020-2022
For more information: contact the county health department

COVID-19 has affected demographic subgroups to different extents. The following two tables show the case breakdown by age group and by race/ethnicity. The tables show the number of cases in each subgroup and the percent of total cases that occurred in that subgroup. In order to compare subgroups, the percent of the total population in that subgroup is also listed. The column "Qualitative assessment of case count" indicates whether there were more or fewer cases in that subgroup than the population would lead one to expect. For example, if 10% of cases occurred in a subgroup, but 15% of the total population were in that subgroup, then the burden of COVID-19 would be lower than expected. If the percent of cases were equal to the percent of population, then the burden would be in line with what one would expect. The label of "close to the expected number of cases" is given when the percent of cases for a specified group is less than 2.5% above or below the percent of total population in the specified group.

When considering the population size of each age category, the 18 to 29 age group had much higher than expected case rates in all three counties, while the 65 and older age group had much lower than expected age rates in all three counties.

When considering the population size of each race/ethnicity category, the burden COVID-19 has been much higher in non-White populations compared to White populations in the three counties and beyond. All non-White subgroups had close to or higher than expected case rates, other than the Asian population in Benton County. In all three counties, the case rate among White populations has been below what would be expected given their share of the population.

Table 9-1: Newly confirmed COVID-19 cases by age group and location

County	Age group	Case count	Percent of cases in age group	Percent of population	Qualitative assessment of case count
Benton	Under 18	2,665	17.7%	16.4%	Close to expected # of cases
	18 to 29	6,269	41.5%	30.4%	Above expected # of cases
	30 to 49	3,310	21.9%	20.7%	Close to expected # of cases
	50 to 64	1,628	10.8%	17.0%	Below expected # of cases
	65 and older	1,189	7.9%	15.5%	Below expected # of cases
	Unknown	28	0.2%	N/A	N/A
Lincoln	Under 18	1,313	18.8%	16.9%	Close to expected # of cases
	18 to 29	1,277	18.3%	10.7%	Above expected # of cases
	30 to 49	2,239	32.0%	20.1%	Above expected # of cases
	50 to 64	1,199	17.1%	24.4%	Below expected # of cases
	65 and older	950	13.6%	27.9%	Below expected # of cases
	Unknown	19	0.3%	N/A	N/A
Linn	Under 18	4,846	18.4%	22.7%	Below expected # of cases
	18 to 29	5,555	21.1%	14.8%	Above expected # of cases
	30 to 49	8,283	31.4%	24.4%	Above expected # of cases
	50 to 64	4,538	17.2%	19.8%	Below expected # of cases
	65 and older	3,140	11.9%	18.3%	Below expected # of cases
	Unknown	12	0.0%	N/A	N/A

Data source: OPERA; United States Census Bureau, America Community Survey, Table B01001
Time period: 2020-2022; 2016-2020
For more information: contact the county health department

Table 9-2: Newly confirmed COVID-19 Cases by race/ ethnicity and location

County	Race/Ethnicity	Case count	Percent of all cases	Percent of population	Qualitative assessment of case count
Benton	American Indian or Alaska Native	169	1.1%	0.7%	Close to expected # of cases
	Asian	513	3.4%	7.4%	Below expected # of cases
	Black or African American	237	1.6%	1.1%	Close to expected # of cases
	Hispanic or Latinx	1,528	10.1%	7.6%	Above expected # of cases
	Native Hawaiian or Pacific Islander	42	0.3%	0.2%	Close to expected # of cases
	Multiple races	128	0.8%	4.9%	Below expected # of cases
	Other	2,311	15.3%	2.2%	Above expected # of cases
	White	9,539	63.2%	83.4%	Below expected # of cases
	Unknown/Refused	2,150	14.2%	N/A	N/A
Lincoln	American Indian or Alaska Native	337	4.8%	2.5%	Above expected # of cases
	Asian	66	0.9%	1.1%	Close to expected # of cases
	Black or African American	51	0.7%	0.3%	Close to expected # of cases
	Hispanic or Latinx	1,042	14.9%	9.4%	Above expected # of cases
	Native Hawaiian or Pacific Islander	28	0.4%	0.2%	Close to expected # of cases
	Multiple races	135	0.2%	5.8%	Below expected # of cases
	Other	629	9.0%	3.0%	Above expected # of cases
	White	4,519	64.6%	87.1%	Below expected # of cases
	Unknown/Refused	1,232	17.6%	N/A	N/A
Linn	American Indian or Alaska Native	357	1.4%	0.9%	Close to expected # of cases
	Asian	210	0.8%	1.1%	Close to expected # of cases
	Black or African American	163	0.6%	0.5%	Close to expected # of cases
	Hispanic or Latinx	2,330	8.8%	9.4%	Close to expected # of cases
	Native Hawaiian or Pacific Islander	53	6.6%	0.2%	Above expected # of cases
	Multiple races	191	0.7%	5.4%	Below expected # of cases
	Other	2,053	7.8%	3.1%	Above expected # of cases
	White	18,039	68.4%	88.8%	Below expected # of cases
	Unknown/Refused	5,308	20.1%	N/A	N/A

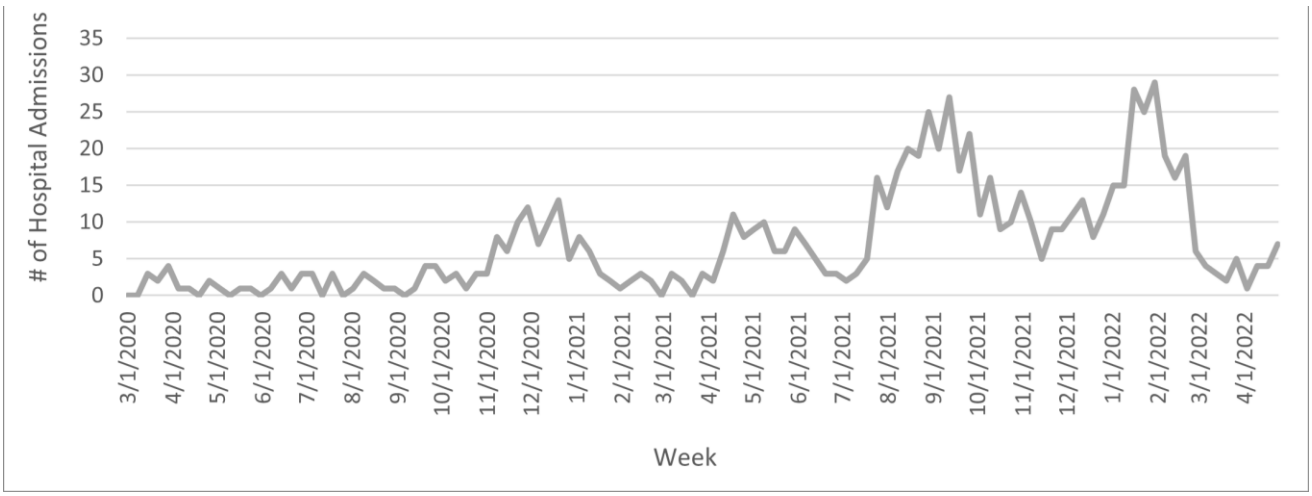
Data source: OPERA; United States Census Bureau, America Community Survey, Table B02001, B03003
Time period: 2020-2022; 2016-2020
For more information: contact the county health department

Hospitalizations

Severe COVID-19 disease can cause viral pneumonia and raise the risk of cardiac events. Across Oregon, about 4% of reported COVID-19 cases require hospitalization. However, that proportion has not remained constant throughout the pandemic. The graphs below show weekly COVID-19 hospital admissions in the three counties.

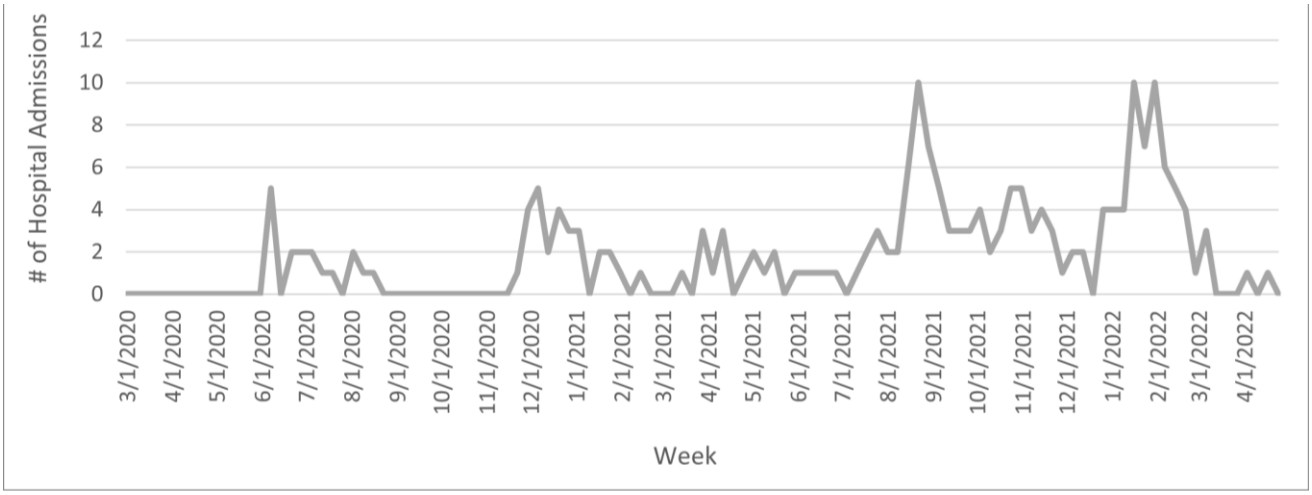
Hospitalization trends have largely mirrored case rates throughout most of the pandemic, with about 4% of reported cases resulting in a hospital admission. However, this trend broke during the Omicron-caused surge in January 2022. While the number of Omicron cases was between 3 and 6 times higher than the number of Delta cases during August 2021, the hospitalization rate was mostly the same during the two surges. This has been attributed to higher vaccination rates in January 2022, and to the likelihood that the Omicron variant caused less severe illness than the Delta variant for most people.

Figure 9-4: Number of COVID-19 hospital admissions in Benton County over time



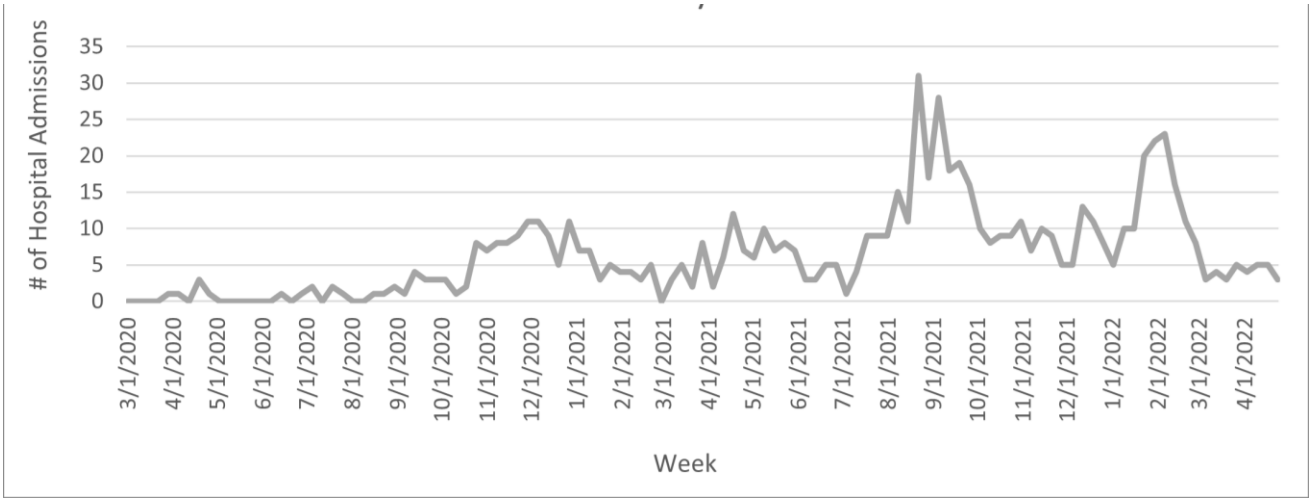
Data source: OPERA
Time period: 2020-2022
For more information: contact the county health department

Figure 9-5: Number of COVID-19 hospital admissions in Lincoln County over time



Data source: OPERA
Time period: 2020-2022
For more information: contact the county health department

Figure 9-6: Number of COVID-19 hospital admissions in Linn County over time



Data source: OPERA
Time period: 2020-2022
For more information: contact the county health department

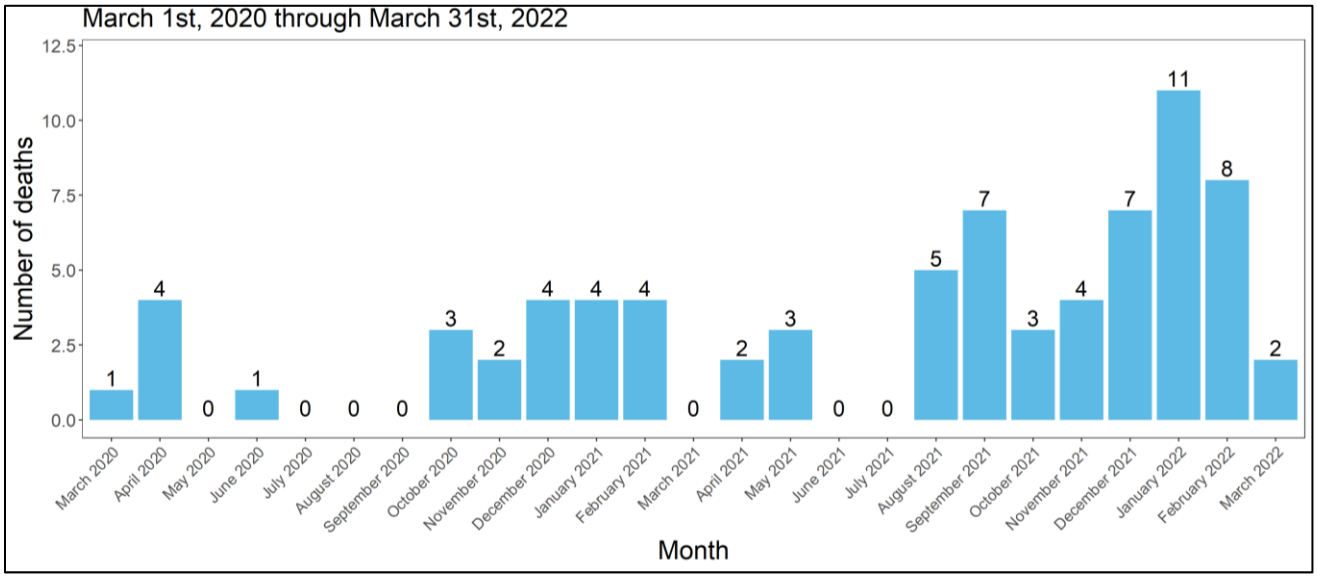
Mortality

During the period between the beginning of the pandemic until the end of March 2022, 437 people died of COVID-19 in the LBL region. Figures 9-7 to 9-9 below show the number of deaths each month, separated by county.

COVID-19 deaths follow the same trends as cases, with the exception of the much smaller than expected rise in the death rate during the January 2022 Omicron surge.

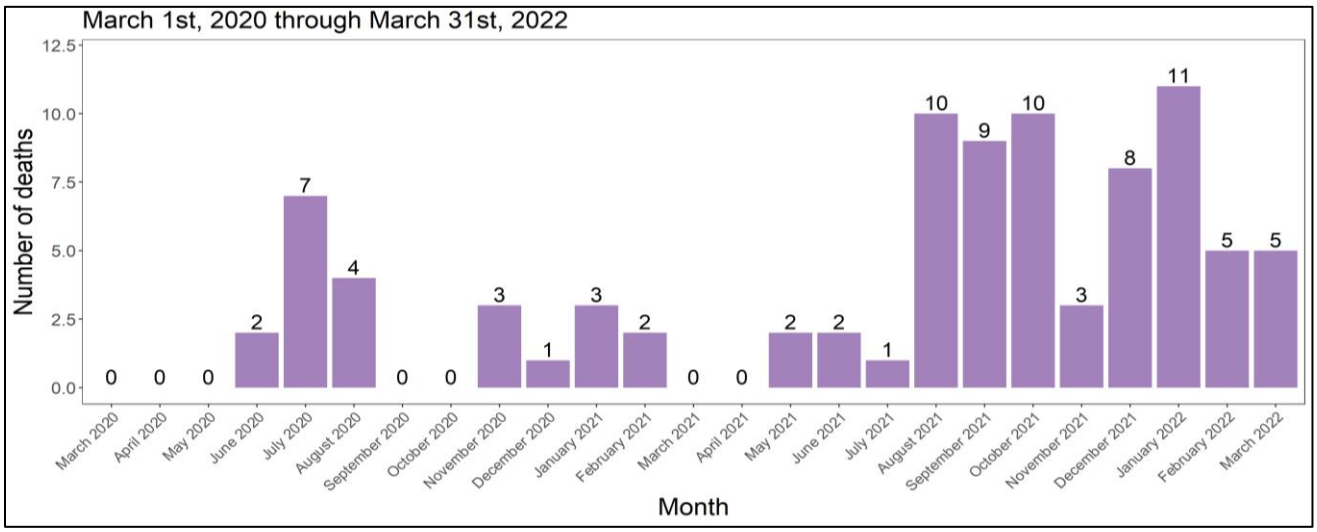
Benton County's number of COVID-19 deaths per 100,000 people is less than half of Lincoln County's number of deaths per 100,000 people, and 37% of Linn County's number of deaths per 100,00 people (Table 9-3). These numbers are not adjusted for age, and a large portion of Benton County's population is college age, which has a lower risk of death than older populations. However, this difference is still very stark.

Figure 9-7: Number of COVID-19 deaths in Benton County over time



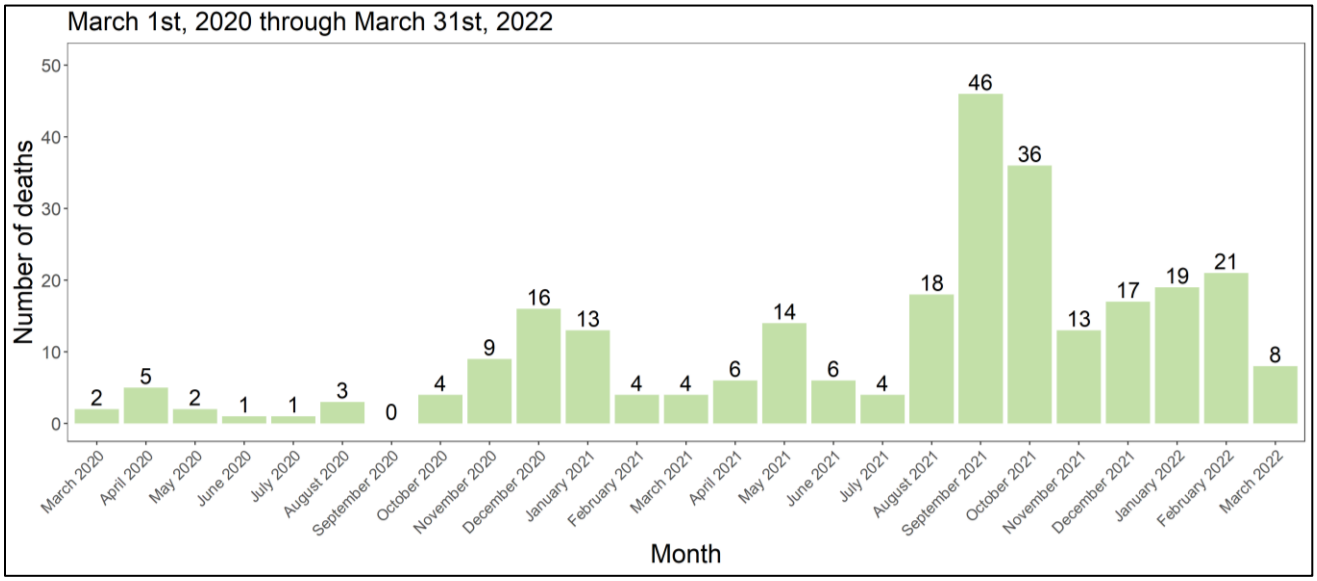
Data source: OPERA
Time period: 2020-2022
For more information: contact the county health department

Figure 9-8: Number of COVID-19 deaths in Lincoln County over time



Data source: OPERA
Time period: 2020-2022
For more information: contact the county health department

Figure 9-9: Number of COVID-19 deaths in Linn County over time



Data source: OPERA
Time period: 2020-2022
For more information: contact the local health department

Table 9-3: Number of COVID-19 deaths per 100,000 people by location

County	Number of deaths	Population	Deaths per 100,000 people
Benton	75	95,184	79
Lincoln	88	50,395	175
Linn	274	128,610	213

Data source: OPERA
Time period: March 2020-March 2022
For more information: contact the local health department

Vaccination

The first COVID-19 vaccines were developed in record time. Less than one year elapsed from the identification of the first United States case in January 2020 until emergency use authorization of the first vaccine in December 2020. Despite the rapid development, the vaccines were subject to rigorous and ongoing safety evaluations and have been authorized for wider segments of the population as additional safety and effectiveness studies have been submitted to the FDA. In May 2022, at least one COVID-19 vaccine was authorized for children as young as five years old. The CDC has recommended that most people complete a two-dose series of the COVID-19 vaccine, followed by a booster dose.

The rollout of the first COVID-19 vaccines in Oregon in January and February 2021 led to large vaccine uptake in the spring of 2021. There were both occupation and age-based eligibility requirements set by the Oregon Health Authority due to the limited supply of COVID-19 vaccines initially. Every couple of

weeks another population group became eligible for the vaccine, leading to consistently high demand for the first six months. After most individuals who wanted a vaccine received their first dose, vaccine uptake slowed, and has been growing slowly but steadily since around June 2021.

Benton County has the highest vaccination rate among the three counties in the LBL region. Linn County falls behind both Lincoln and Benton counties in the percent of community members with at least one dose of a COVID-19 vaccine. The COVID-19 vaccination data below utilizes Portland State University (PSU) population estimates, whereas the COVID-19 case and mortality data utilizes US Census population estimates. This accounts for the slight differences in population size.

COVID-19 vaccination rates vary by race/ethnicity and age. The LBL region's Native Hawaiian or Pacific Islander population had the highest rates of COVID-19 vaccination. Both Linn and Lincoln counties' Hispanic or Latinx populations had the lowest vaccination rates of any race/ethnicity group. In Benton County, the population with the lowest COVID-19 vaccination rate is the Black or African American population (Figure 9-5). Those ages 0-4 have the lowest rates of COVID-19 vaccination in the LBL region (Table 9-6). Those ages 6 months to 4 years became eligible for the COVID-19 vaccine in June 2022.

Table 9-4: Number of COVID-19 vaccinations by location

County	Number with 1+ dose	Population	Percent with 1+ dose
Benton	77,105	93,976	82.0%
Lincoln	40,065	50,903	78.7%
Linn	79,584	130,440	61.0%

Data source: Oregon Health Authority Workbook: Oregon Vaccine Metrics Summary Table (state.or.us)
Time period: January 2020 – February 2023
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/OregonVaccineMetricsSummaryTable/OregonCOVID-19VaccineProgressSummaryTable?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3AisGuestRedirectFromVizportal=y&%3Aembed=y

Table 9-5: Number of people with at least one dose of a COVID-19 vaccination by rarest race/ethnicity and location

County	Race/Ethnicity	Number vaccinated	Estimated population size	Percent of population with at least one dose
Benton	American Indian or Alaska Native	1,997	2,422	82.5%
	Asian	5,604	6,871	81.6%
	Black or African American	1,274	1,812	70.3%
	Hispanic or Latinx	4,408	5,976	73.8%
	Native Hawaiian or Pacific Islander	639	609	104.9%*
	White	59,266	74,370	79.7%
	Other	*	*	*
Lincoln	American Indian or Alaska Native	2,391	3,313	72.2%
	Asian	749	904	82.9%
	Black or African American	539	761	70.8%
	Hispanic or Latinx	2,495	4,233	58.9%
	Native Hawaiian or Pacific Islander	303	303	100.0%
	White	31,923	39,787	80.2%
	Other	*	*	*
Linn	American Indian or Alaska Native	2,803	4,829	58.0%
	Asian	1,711	2,888	59.2%
	Black or African American	947	1,643	57.6%
	Hispanic or Latinx	5,267	11,292	46.6%
	Native Hawaiian or Pacific Islander	588	836	70.3%
	White	66,275	105,572	62.8%
	Other	*	*	*

** The Oregon Health Authority database uses the "Other" race category as a default when race is unknown. Because of this, the category includes many more individuals than those who would likely indicate "Other" race on the United States Census. Therefore, it is not possible to estimate the vaccination rate among "Other."*
**Vaccination rates over 100% is due to more individuals within race/ethnicity categories received a vaccine with a current address in Oregon than are estimated in the population.*
Data source: Oregon Health Authority Workbook: Oregon Vaccine Metrics Summary Table (state.or.us)
Time period: December 2020 - February 2023
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/OregonVaccineMetricsSummaryTable/OregonCOVID-19VaccineProgressSummaryTable?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3AisGuestRedirectFromVizportal=y&%3Aembed=y

Table 9-6: Number of people with at least one dose of a COVID-19 vaccine by age group and location

County	Age group	Number vaccinated	Estimated population	Percent of population with at least one dose
Benton	0 to 4	988	3,642	27.1%
	5 to 11	3,392	5,746	59.04%
	12 to 17	4,323	5,372	80.47%
	18 to 49	38,447	51,002	75.38%
	50 to 64	12,995	15,491	83.89%
	65 and older	16,960	12,723	133.3%*
Lincoln	0 to 4	224	1,957	11.4%
	5 to 11	1,257	3,225	38.98%
	12 to 17	1,964	2,853	68.85%
	18 to 49	12,328	15,664	78.70%
	50 to 64	9,224	11,235	82.10%
	65 and older	15,068	15,970	94.35%
Linn	0 to 4	424	7,711	5.5%
	5 to 11	2,462	11,182	22.02%
	12 to 17	4,337	9,661	44.89%
	18 to 49	31,744	51,504	61.63%
	50 to 64	17,478	24,463	71.45%
	65 and older	23,139	25,920	89.27%

* *Vaccination rates over 100% are due to more individuals within an age category having received a vaccine with a current address in Oregon than are estimated in the population.*

Data source: Oregon Health Authority Workbook: Oregon Vaccine Metrics Summary Table (state.or.us)
Time period: December 2020 - February 2023
For more information: https://visual-data.dhsoha.state.or.us/t/OHA/views/OregonVaccineMetricsSummaryTable/OregonCOVID-19VaccineProgressSummaryTable?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3AisGuestRedirectFromVizportal=y&%3Aembed=y

10 Community Voices

In partnership with Samaritan Health Services, various forms of primary data were collected from community members and organizations to inform our assessment of regional health priorities. These different formats include the Regional Community Health Survey, Focus Groups, and Key Informant Interviews.

Regional Community Health Survey

Please see the Methodology section in Chapter 1: Introduction for more information about the Regional Community Health Survey (Community Survey). A total of 2,812 responses to the survey were collected through convenience sampling distributed by a broad range of channels. Table 10-1 shows a summary of demographic information about survey respondents. The highest proportion of respondents lived in Benton County (37%), followed by equal proportions from Lincoln (27%) and Linn County (27%). The survey invited participation from anyone who lived, worked, went to school, or spent time in Linn, Benton, or Lincoln County, and 9% of respondents lived outside the LBL region. Respondents were primarily middle-aged (age 25-64), identified as white or Caucasian, and were predominantly female (75%).

Table 10-1: Demographic information from the 2,812 Community Survey respondents

Respondent Characteristics	Percent of responses
County of residence	
Benton	37%
Lincoln	27%
Linn	27%
Other	9%
(Missing)	2%
Age	
Under 18 years old	1%
18 to 24 years old	6%
25 to 44 years old	35%
45 to 64 years old	36%
65 to 84 years old	17%
85 years or older	1%
(Missing)	4%
Race/ethnicity*	
African American or Black	3%
American Indian or Alaska Native	10%
Asian	3%
Pacific Islander	1%
White or Caucasian	80%
Hispanic or Latino	11%
Middle Eastern, North African, or Arab	1%
(Missing)	10%
Gender	
Female	75%
Male	22%
Non-binary or other gender	3%
(Missing)	1%
Languages spoken at home*	
English	88%
Spanish	4%
Arabic	1%
Other languages or multiple languages	5%
(Missing)	5%

**Respondents could check multiple categories, so percentages do not add up to 100%*

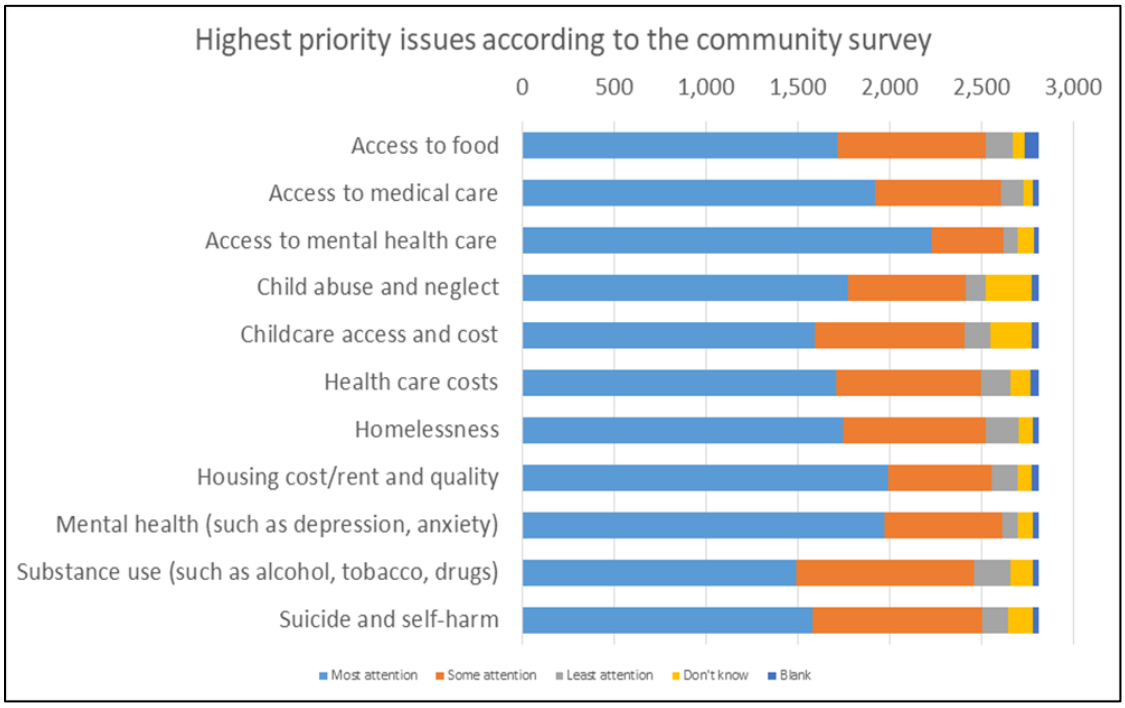
The Community Survey asked respondents to rate both the overall health of their community and their overall health as an individual. Most respondents felt that their community was 'healthy' (30%) or 'sort of healthy' (51%), while people felt that their individual health was overall slightly healthier (49% reported being 'healthy' while 30% reported being 'sort of healthy').

Table 10-2: Perceived health status among Community Survey respondents

Questions	Percent of responses
"How healthy is your community?"	
Very healthy	3%
Healthy	30%
Sort of healthy	51%
Unhealthy	13%
Very unhealthy	2%
"How healthy are you?"	
Very healthy	13%
Healthy	49%
Sort of healthy	30%
Unhealthy	7%
Very unhealthy	1%

Additionally, the Community Survey also asked respondents to consider 30 topic areas and rate each topic as deserving the 'least attention', 'some attention', or 'most attention' (or 'don't know') in their community. Figure 10-1 shows that the topics with the highest proportion of 'most attention' responses included access to mental health care (83%), housing cost/rent and quality (74%), mental health (such as depression, anxiety) (74%), child abuse and neglect (71%), and access to medical care (65%).

Figure 10-1: High priority issues from Community Survey respondents



Qualitative Engagement Sessions

Please see the Methodology section in Chapter 1: Introduction for more detailed information on how focus groups and key informant interviews were conducted.

Focus Groups

Sixteen focus groups were completed with community members of Linn, Benton, and Lincoln counties. The frequency in which a given topic was discussed was totaled across all focus group sessions. Access to quality care was brought up most frequently by participants, having nearly four times the occurrence of any other topic. Other topics that repeatedly came up across focus groups included 1) a lack of diversity, equity, inclusion, and cultural representation in the community, 2) pregnancy, child health, and child education, 3) access to affordable housing, 4) food insecurity, 5) mental health, 6) and substance use and misuse. Participants also discussed chronic disease, transportation, and access to information, although these topics were brought up less frequently than those listed above.

Key Informant Interviews

Thirty-one key informant interviews were completed with community representatives of Linn, Benton, and Lincoln counties. Significant words and phrases from each key informant interview were identified and placed into thematic groups. For example, the statement "the COVID-19 pandemic has been very challenging" would be placed under the thematic group, disease and disability. The thematic groups identified from the key informant interviews include (in no particular order) 1) community health & quality of life, 2) mental & behavioral health, 3) access to care & resources, 4) disease & disability. The topics included in each of these thematic groups can be found in Table 10-3. Mentions of the topics within each thematic group varied by county as seen in Figure 10-4.

Table 10-3: Thematic groups from key informant interviews and their associated topics

Thematic group	Topics included
Community health & quality of life	• Lack of safe/accessible housing • Poor nutrition/food insecurity • Overwork/time pressures • Lack of exercise/fitness • Lack of access to education
Mental & behavioral health	• Mental & behavioral health needs • Substance use disorder • Social isolation/lack of community • Suicidality in youth • Tobacco use • Teen births
Access to care & resources	• Lack of providers, appointments, and support • Lack of cultural and linguistic competence/trust • Cost of care/insurance • Lack of transportation

Disease & disability	• Diabetes • Disability/accessibility issues • COVID-19 impacts • Chronic health conditions • Senior health • Socioeconomic inequality

Table 10-4: Percent of key informant responses by thematic group and location

County	Thematic group	Percent of key informant interviews
Benton	Community health & quality of life	33%
	Mental & behavioral health	28%
	Access to care & resources	28%
	Disease & disability	12%
Lincoln	Community health & quality of life	11%
	Mental & behavioral health	43%
	Access to care & resources	24%
	Disease & disability	16%
Linn	Community health & quality of life	31%
	Mental & behavioral health	31%
	Access to care & resources	21%
	Disease & disability	14%

11 Summary

The 2022 - 2026 Regional Health Assessment (RHA) aimed to describe and compare the health status and conditions affecting residents in Linn, Benton, and Lincoln counties. Oregon is composed of 36 counties, 35 of which were ranked based on overall health outcomes and health factors in the 2022 County Health Rankings. Benton County ranked 1st among Oregon counties for health outcomes (including measures of length of life and quality of life) and 2nd for health factors (including health behaviors, clinical care, social and economic factors, and physical environment). [80] Linn County was ranked in the middle of the 35 Oregon counties that received a ranking (16th for health outcomes and 17th for health factors) while Lincoln County ranked 27th for health outcomes and 33rd for health factors. These summary rankings highlight the variability within the LBL region as well as the potential opportunities to improve community health.

The 2022 RHA also identified challenges that individual counties and the region face. Benton County has better health outcomes than Linn and Lincoln counties in regard to communicable disease, gestational parent and child health, mental health, and chronic disease indicators. Conversely, Benton County tends to have higher economic disparities compared to other counties in the region. The identification of areas of weakness helps to inform public health interventions, ensure high risk populations are being correctly targeted for community programs, and improve needed access to care and resources.

Key Themes

Based on review of the data presented in this report, the Partnership for Community Health identified seven key themes. The themes are presented below in alphabetical order, with a brief summary of key data points for each topic.

Access to affordable housing & homelessness

- The percent of the K-12 student population experiencing homelessness in Lincoln County was 3 times higher than the state percentage in 2019-2020.
- The LBL region had a total population of around 870 peoples experience homelessness in 2019.
- Half of rented regional households in the LBL region experienced a housing burden in 2020.

Access to quality care

- In Linn and Lincoln counties, the rates of Primary Care Physicians is lower than the Oregon in 2020.
- In the LBL region, the rate of dentists is the below Oregon in 2020.
- In Linn and Lincoln counties, the rates of Behavioral Health Providers is lower than the Oregon in 2020.
- 14 service areas in the LBL region had less than 5 mental health care providers per 10,000 individuals in 2021; 5 service areas in the LBL region had no mental health providers in 2021.

Equity, Diversity & Inclusion

- The percentage of individuals living in poverty with a disability within Linn and Lincoln County is higher than the state in 2021.
- 1 in 9 individuals within the region spoke another language at home in 2020.
- Minoritized racial and ethnic groups in the region are more likely to live in poverty than White individuals in 2020.

Food Insecurity/Access

- 1 in 10 households in Benton County utilized SNAP benefits. This is lower than the other two counties (1 in 5) and the state in 2020.
- In 2020, the LBL region experienced higher percentages of food insecurity (1 in 8 individuals) in comparison to the state.
- Only 3.5 out of 10 people in the LBL region lived within walking distance to a grocery store in 2019.

Healthy Youth & Families

- Prenatal tobacco use affects 1 of every 6 pregnancies in both Lincoln and Linn counties and 1 of every 10 pregnancies in Benton County.
- In Linn and Lincoln counties, the number of pregnancies per 1,000 ages 15 to 19 is higher than the state in 2020.
- The LBL region had higher numbers of child abuse victims per 1,000 compared to Oregon in 2021.
- Lincoln County had almost twice as many children in foster care per 1,000 in comparison to Oregon in 2021.

Mental Health

- Over 1 in 5 residents in the LBL region have a diagnosis of depression in 2020.
- The suicide rate in Lincoln County was double that of Linn and Benton counties in 2020.
- 1 in 3 eighth graders in Lincoln County report being bullied. This is higher than Oregon in 2019.
- 2 in 5 11th graders felt sad or hopeless almost every day for two weeks in 2019.

Substance Use and Misuse

- Lincoln County drug overdose death rate per 100,000 persons is triple the rate of Benton County in 2019.
- In Linn and Lincoln counties, 1 in 6 individuals smoked cigarettes in 2020.
- 1 out of 3 eleventh graders report using E-Cigarettes in Linn County. This is higher than the other two counties and Oregon in 2019.
- 1 in 9 8th graders report using alcohol in the LBL region in 2019.
- In the LBL region, the percent of 11th graders who report misusing prescription drugs is higher than the state in 2019.

Conclusion

Community partners in the LBL region have already implemented a variety of programs aimed at improving the health status of residents including tobacco prevention and education programs, crisis services, well water testing, among countless others. Future interventions will further improve environmental conditions and reduce the health disparities associated with adverse health outcomes through the Regional Health Improvement Plan.

This report was a collaborative project that would not have been possible without the help and dedication of Benton, Lincoln, and Linn County Public Health Departments, Samaritan Health Services, InterCommunity Health Network Coordinated Care Organization, the Confederated Tribes of Siletz Indians, and United Way of Linn, Benton & Lincoln Counties. The project not only provided a safe place for community partners to express their program needs and concerns but allowed for the growth of relationships and strengthening of communication bonds between agencies. With ongoing collaboration, we will continue to strive to eliminate disparities and improve the health of all LBL community members.

Appendix 1: Acronyms used

ACS	American Community Survey (data source)
CDC	Centers for Disease Control and Prevention
LBL	Linn, Benton, and Lincoln counties (the geographical area of focus for this assessment)
BRFSS	Behavioral Risk Factor Surveillance System (data source)
IHN-CCO	InterCommunity Health Network Coordinated Care Organization (a subsidiary of Samaritan Health Services that administers the Oregon Health Plan for beneficiaries living in Linn, Benton, and Lincoln counties)
OHA	Oregon Health Authority (Oregon's state health agency, which oversees statewide public health efforts as well as the Oregon Health Plan)
OHP	Oregon Health Plan (Oregon's Medicaid program, managed by the Oregon Health Authority)
OPHAT	Oregon Public Health Assessment Tool (data source)
RHA	Regional Health Assessment
SDOH	Social Determinants of Health
STD	Sexually Transmitted Disease

Appendix 2: Annotated list of select data sources

The following list provides more detail about some of the most common data sources used in the Regional Health Assessment report:

Behavioral Risk Factor Surveillance System (BRFSS)

The BRFSS, administered by the United States Centers for Disease Control and Prevention (CDC), continuously collects health data via telephone surveys. Adults residing in the United States are selected through random digit dialing conducted by public health departments and university partners. Approximately 400,000 adults residing in the United States are surveyed each year. Learn more at: https://www.cdc.gov/brfss/index.html

American Community Survey (ACS)

The American Community Survey is randomly administered to approximately 3.5 million United States households each year and collects information on socioeconomic, demographic, and housing characteristics. A two-phase systematic sampling scheme is utilized to select eligible housing units. If selected, participants are legally required to accurately complete the survey. In 2020, 74.2% of selected households in Oregon successfully responded to the survey. The data presented in this report was extracted from 5-year estimates between 2016 and 2020. Learn more: https://www.census.gov/acs/www/methodology/sample-size-and-data-quality/response-rates/index.php.

County Health Rankings

The County Health Rankings compiles and standardizes data from secondary sources to rank counties within states on important health indicators. The program was developed by the Wisconsin Population Health Institute with funding from the Robert Wood Johnson Foundation and uses data from reliable national and local data sources. The County Health Ranking's health indicator are regularly age-adjusted to allow comparability among counties and over time. Rankings are updated annually, though the data used to calculate rankings varies in recency. Learn more at: https://www.countyhealthrankings.org/explore-health-rankings/our-methods.

Oregon State Health Assessment

The Oregon State Health Assessment is conducted every five years with the aim of describing the health of Oregon residents. The assessment uses data extracted from a variety of primary data sources to collect information on health, demographic characteristics, and environmental factors. Learn more at: https://www.oregon.gov/oha/ph/about/pages/healthstatusindicators.aspx.

Oregon Healthy Teens Survey

The Oregon Healthy Teens survey is a comprehensive school-based survey that is administered to eighth and eleventh graders across the state during odd numbered years. Participation in the survey is confidential and voluntary. The survey covers a variety of topics, including but not limited to substance

use, healthy behaviors, and health conditions. The most recent available data is from 2019, including approximately 27,000 valid surveys were submitted by students. Learn more at: https://www.oregon.gov/oha/ph/birthdeathcertificates/surveys/oregonhealthyteens/pages/index.aspx

ALERT Immunization Information System

The ALERT Immunization Information System is a computerized registry that contains immunization records for children and adults across Oregon. Medical providers can directly input immunizations into the database to allow for efficient documentation across practices. One hundred percent of public clinics and ninety-two percent of private clinics utilize the database. All sites that administer COVID-19 vaccinations are required to report immunization administration to ALERT IIS. Learn more at: https://www.oregon.gov/oha/ph/preventionwellness/vaccinesimmunization/alert/pages/index.aspx.

Oregon Public Health Assessment Tool (OPHAT)

The Oregon Public Health Assessment Tool (OPHAT) is a web-based tool used by local and state public health agencies to access, analyze, and present data from multiple datasets.

Oregon Public Health Epidemiologist User System (Orpheus)

The Oregon Public Health Epidemiologist User System (Orpheus) is the electronic disease surveillance database used for all communicable diseases in the state of Oregon. Epidemiologists at the local and state level access the data when analyzing disease trends and conducting case investigations with sick persons.

Oregon Pandemic Emergency Response Application (Opera)

The Oregon Pandemic Emergency Response Application (Opera) is the Oregon electronic-disease surveillance system used to track all COVID-19 related health outcomes.

Oregon Environmental Public Health Tracking

Oregon Environmental Public Health Tracking complies data from the United States Environmental Protection Agency (EPA), hospital records, United States census data, and surveillance data from public health departments to improve the understanding of the role that environmental hazards and exposures have on health. The system is part of the larger CDC's National Tracking Network. Learn more at: https://www.oregon.gov/oha/PH/HealthyEnvironments/TrackingAssessment/EnvironmentalPublicHealthTracking/Pages/index.aspx

Appendix 3: References

[1] County Health Rankings. (2022). Explore Health Rankings. Retrieved from https://www.countyhealthrankings.org/explore-health-rankings.

[2] Portland State University. (2022). Population Estimate Reports. Retrieved from https://www.pdx.edu/population-research/population-estimate-reports.

[3] The Oregon History Project. (2014). A changing Landscape and the Beginnings of White Settlement. Retrieved from https://www.oregonhistoryproject.org/articles/a-changing-landscape-and-the-beginnings-of-white-settlement/#.YsR_anbMKUk.

[4] Confederate Tribes of Grand Ronde. (2022). Our Story. Retrieved from https://www.grandronde.org/history-culture/history/our-story/.

[5] Oregon State University. (2022). Enrollment and demographic reports. Retrieved from https://institutionalresearch.oregonstate.edu/enrollment-and-demographic-reports.

[6] University of Oregon, Institute for Policy Research and Engagement. (2021). Lincoln County Economic Resilience. Retrieved from https://www.ocwcog.org/wp-content/uploads/2021/08/EcoRes_County-Profile_Lincoln_Final.pdf.

[7] Oregon State University, Extensive Service. (2020). Oregon By the Numbers. Retrieved from https://www.tfff.org/sites/default/files/OregonByTheNumbers2020_23Nov.pdf.

[8] Oregon Health and Science University. (2021). Oregon Office of Rural Health. Retrieved from https://www.ohsu.edu/oregon-office-of-rural-health/about-rural-and-frontier-data.

[9] Oregon State University. (2023). About. Retrieved from https://oregonstate.edu/about.

[10] Oregon State University. (2023). Future Students. Retrieved from https://oregonstate.edu/future.

[11] NIHCM. (2022). Climate Change is Affecting Our Mental Health. Retrieved from https://nihcm.org/publications/climate-change-is-affecting-our-mental-health.

[12] Oregon.Gov. (2022). Oregon Office of Resilience & Emergency Management. Retrieved from https://www.oregon.gov/dhs/EmergencyManagement/Pages/index.aspx.

[13] Oregon Health Authority. (2022). Summer 2022 Oregon ESSENCE Hazard Report. Retrieved from https://digital.osl.state.or.us/islandora/object/osl%3A996977.

[14] Oregon Public Broadcasting. (2020). Heat Deaths. Retrieved from https://www.opb.org/pdf/OREGON_heat_deaths_revised_1628632311939.pdf.

[15] Oregon.Gov. Drought. Retrieved from https://www.oregon.gov/OWRD/programs/climate/droughtwatch/Pages/default.aspx

[16] United States Environmental Protection Agency. (2014). Important Information About Your Drinking Water. Retrieved from https://www.epa.gov/sites/default/files/2014-04/documents/pn_tthm_haa5_mcl.pdf.

[17] State of Oregon Department of Environmental Quality. (2017). 2017 Oregon Material Recovery and Waste Generation Rates Report. Retrieved from https://www.oregon.gov/deq/FilterDocs/2017mrwgrates.pdf.

[18] State of Oregon Department of Environmental Quality. (2020). 2020 Recovery Rates for Plastic Waste and Food Waste. https://www.oregon.gov/deq/mm/Documents/DEQMMLegReportFoodPlasticWasteGoals2022.pdf

[19] United States Environmental Protection Agency (2023). Toxics Release Inventory (TRI) Program. Retrieved from http://www.epa.gov/toxics-release-inventory-tri-program.

[20] United States Environmental Protection Agency (2020). 2020 TRI Factsheet: State-Oregon. Retrieved from https://enviro.epa.gov/triexplorer/tri_factsheet.factsheet_forstate?pstate=OR&pyear=2020.

[21] State of Oregon Department of Environmental Quality. Cleaner Air Oregon. Retrieved from https://www.oregon.gov/deq/aq/cao/Pages/default.aspx.

[22] United States Department of Human Services. Healthy People 2030: Social Determinants of Health. Retrieved from .https://health.gov/healthypeople/priority-areas/social-determinants-health.

[23] Centers for Disease Control and Prevention. (2014). About Healthy Places. Retrieved from https://www.cdc.gov/healthyplaces/about.htm.

[24] Oregon Health Authority. (2015). Environmental Public Health Tracking. Retrieved from https://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/EnvironmentalPublicHealthTracking/Pages/index.aspx.

[25] Oregon Department of Transportation. (2019). Oregon Transit Network 2019 Report. Retrieved from https://www.oregon.gov/odot/RPTD/RPTD Document Library/Transit-Network-Report.pdf

[26] Lincoln County, Oregon. Transit Intercity Bus Schedule. Retrieved from https://www.co.lincoln.or.us/transit/page/transit-intercity-bus-schedule-0.

[27] Active Living Research. (2011). Research Brief: The Power of Trails for Promoting Physical Activity in Communities. Retrieved from http://activelivingresearch.org/files/ALR_Brief_PowerofTrails_0.pdf.

[28] Oregon State University, Extensive Service. (2020). Oregon By the Numbers. Retrieved from https://www.tfff.org/sites/default/files/OregonByTheNumbers2020_23Nov.pdf.

[29] World Health Organization. (2022). Social determinants of health. Retrieved from https://www.who.int/health-topics/social-determinants-of-health.

[30] United States Census Bureau. (2020). Table S1901: Income in the Past 12 Months (In 2020 Inflations-Adjusted Dollars). Retrieved from https://data.census.gov/cedsci/table?q=income.

[31] County Health Rankings. (2022). Income Inequality. Retrieved from https://www.countyhealthrankings.org/explore-health-rankings/county-health-rankings-model/health-factors/social-economic-factors/income/income-inequality?year=2022.

[32] United States Department of Agriculture. (2021). Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Retrieved from . https://www.fns.usda.gov/wic/about-wic.

[33] United States Department of Agriculture. (2013). Supplemental Nutrition Assistance Program (SNAP). Retrieved from https://www.fns.usda.gov/snap/supplemental-nutrition-assistance-program.

[34] Feeding America. Hunger and Food Insecurity. Retrieved from What is Food Insecurity? | Feeding America.

[35] Community Service Consortium. (2021). Linn Benton Food Share- Everybody Eats. Retrieved from https://communityservices.us/wp-content/uploads/2022/10/Newsletter-Winter-2021-8.5x11.pdf.

[36] Food Share of Lincoln County. (2021). Annual Report Fiscal Year 2021. Retrieved from https://foodsharelc.org/wp-content/uploads/2022/07/Annual-Report-2021.pdf.

[37] Oregon Housing and Community Services. (2019). 2019 Point-in-Time County. Retrieved from https://public.tableau.com/app/profile/oregon.housing.and.community.services/viz/2019Point-in-TimeDashboard/Story1

[38] Eberly LA, Kallan MJ, Julien HM, et al. Patient Characteristics Associated With Telemedicine Access for Primary and Specialty Ambulatory Care During the COVID-19 Pandemic [published correction appears in JAMA Netw Open. 2021 Feb 1;4(2):e211913]. JAMA Netw Open. 2020;3(12):e2031640. Published 2020 Dec 1. doi:10.1001/jamanetworkopen.2020.31640.

[39] Oregon Health Authority. (2020). Induced Abortion Data. Retrieved from https://www.oregon.gov/oha/PH/BirthDeathCertificates/VitalStatistics/Pages/Induced-Abortion-Data.aspx.

[40] UCLA School of Law, Williams Institute. (2022). How Many Adults and Youth Identify as Transgender in the United States. Retrieved from https://williamsinstitute.law.ucla.edu/publications/trans-adults-united-states/.

[41] Association of American Medical Colleges. (2021). The Complexities of Physician Supply and Demand: Projections for 2019 to 2023. Retrieved from https://www.aamc.org/media/54681/download.

[42] Association of American Medical Colleges. (2021). The Complexities of Physician Supply and Demand: Projections for 2019 to 2023. Retrieved from https://www.aamc.org/media/54681/download.

[43] Oregon Health Authority. (2021). Oregon's Health Care Workforce Less Diverse than State, Access Still Challenging in Rural Areas. Retrieved from https://content.govdelivery.com/accounts/ORDHS/bulletins/2be996f.

[44] Centers for Disease Control and Prevention. (2022). Improving Children's Behavioral Health. Retrieved from https://www.cdc.gov/childrensmentalhealth/features/child-mental-health.html.

[45] Centers for Disease Control and Prevention. (2022). Mental Health. Retrieved from https://www.cdc.gov/mentalhealth/index.htm.

[46] Centers for Disease Control and Prevention. (2022). About Chronic Diseases. Retrieved from https://www.cdc.gov/chronicdisease/about/index.htm.

[47] American Heart Association. (2019). Heart-Health Screenings. Retrieved from https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease/heart-health-screenings.

[48] Centers for Disease Control and Prevention. (2022). What is Breast Cancer Screening. Retrieved from https://www.cdc.gov/cancer/breast/basic_info/screening.htm.

[49] Charlesworth CJ, Meath TH, Schwartz AL, McConnell KJ. Comparison of Low-Value Care in Medicaid vs Commercially Insured Populations. JAMA Intern Med. 2016;176(7):998-1004. doi:10.1001/jamainternmed.2016.2086.

[50] Allen EM, Call KT, Beebe TJ, McAlpine DD, Johnson PJ. Barriers to Care and Health Care Utilization Among the Publicly Insured. Med Care. 2017;55(3):207-214. doi:10.1097/MLR.0000000000000644.

[51] Capp R, Rooks SP, Wiler JL, Zane RD, Ginde AA. National study of health insurance type and reasons for emergency department use. J Gen Intern Med. 2014;29(4):621-627. doi:10.1007/s11606-013-2734-4.

[52] Oregon Health Authority. (2020). Tobacco Prevention. Retrieved from https://www.oregon.gov/oha/ph/preventionwellness/tobaccoprevention/pages/oregon-tobacco-facts.aspx.

[53] Centers for Disease Control and Prevention. (2022). About Chronic Diseases. Retrieved from https://www.cdc.gov/chronicdisease/about/index.htm.

[54] American Cancer Society. (2022). Lung Cancer. Retrieved from https://www.cancer.org/cancer/lung-cancer/causes-risks-prevention/risk-factors.html.

[55] World Health Organization. (n.d.). Health topics: Infectious diseases. Retrieved from https://www.emro.who.int/health-topics/infectious-diseases/index.html.

[56] United States Department of Health and Human Services. (2021). Office on Women's Health. Retrieved from .https://www.womenshealth.gov/a-z-topics/prenatal-care.

[57] Centers for Disease Control and Prevention. (2020). Smoking During Pregnancy. Retrieved from https://www.cdc.gov/tobacco/basic_information/health_effects/pregnancy/index.htm.

[58] Gill SV, May-Benson TA, Teasdale A, Munsell EG. Birth and developmental correlates of birth weight in a sample of children with potential sensory processing disorder. BMC Pediatr. 2013;13:29. Published 2013 Feb 25. doi:10.1186/1471-2431-13-29.

[59] Centers for Disease Control and Prevention. (2021). About Teen Pregnancy. Retrieved from https://www.cdc.gov/teenpregnancy/about/index.htm.

[60] Centers for Disease Control and Prevention. (2021). Breastfeeding Benefits Both Baby and Mom. Retrieved from https://www.cdc.gov/nccdphp/dnpao/features/breastfeeding-benefits/index.html.

[61] Nandi A, Shet A. Why vaccines matter: understanding the broader health, economic, and child development benefits of routine vaccination. Hum Vaccin Immunother. 2020;16(8):1900-1904. doi:10.1080/21645515.2019.1708669.

[62] Centers for Disease Control and Prevention. (2022). Improving Children's Behavioral Health. Retrieved from https://www.cdc.gov/childrensmentalhealth/features/child-mental-health.html.

[63] Centers for Disease Control and Prevention. (2022). Mental Health. Retrieved from https://www.cdc.gov/mentalhealth/index.htm.

[64] Mental Health America. (2020). Ranking the States. Retrieved from https://www.mhanational.org/issues/ranking-states.

[65] Oregon Health Authority. (2020). Healthier Together Oregon: 2020-2024 State Health Improvement Plan. Retrieved from https://www.oregon.gov/oha/PH/About/Pages/HealthImprovement.aspx.

[66] Centers for Disease Control and Prevention. (2021). About Mental Health. Retrieved from https://www.cdc.gov/mentalhealth/learn/index.htm.

[67] Centers for Disease Control and Prevention. (2022). New CDC data illuminate youth mental health threats during the COVID-19 pandemic. Retrieved from https://www.cdc.gov/media/releases/2022/p0331-youth-mental-health-covid-19.html.

[68] Centers for Disease Control and Prevention. (2020). Smoking and Tobacco Use: Health Effects. Retrieved from https://www.cdc.gov/tobacco/basic_information/health_effects.

[69]Oregon Health Authority. Oregon Tobacco Facts. Retrieved from https://www.oregon.gov/oha/ph/preventionwellness/tobaccoprevention/pages/oregon-tobacco-facts.aspx.

[70] Oregon Health Authority. Opioid Overuse and Misuse. Retrieved from https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/SUBSTANCEUSE/OPIOIDS/Pages/data.aspx.

[71] Koehler K, Drenowatz C. Integrated Role of Nutrition and Physical Activity for Lifelong Health. Nutrients. 2019;11(7):1437. Published 2019 Jun 26. doi:10.3390/nu11071437.

[72] United States Department of Health and Human Services. Physical Activity Guidelines for Americans. Washington, DC: United States Department of Health and Human Services; 2008. Retrieved from https://www.cdc.gov/healthyschools/physicalactivity/guidelines_backup.htm#:~:text=Children%20and%20adolescents%20should%20have,least%203%20days%20a%20week.

[73] United States Department of Health and Human Services. Physical Activity Guidelines for Americans. Washington, DC: United States Department of Health and Human Services; 2008. Retrieved from https://www.cdc.gov/healthyschools/physicalactivity/guidelines_backup.htm#:~:text=Children%20and%20adolescents%20should%20have,least%203%20days%20a%20week.

[74] Bergamo, C., Juarez-Colunga, E., & Capp, R. (2016). Association of mental health disorders and Medicaid with ED admissions for ambulatory care-sensitive condition conditions. The American journal of emergency medicine, 34(5), 820–824. https://doi.org/10.1016/j.ajem.2016.01.023.

[75] Oregon Laws. (2021). Rule 309-019-0225: Assertive Community Treatment (ACT) Definitions. Retrieved from https://oregon.public.law/rules/oar_309-019-0225.

[76] Oregon Laws. (2021). Rule 309-019-0225: Assertive Community Treatment (ACT) Definitions. Retrieved from https://oregon.public.law/rules/oar_309-019-0225.

[77] USA Facts. (2023). United States COVID-19 Cases and Deaths by State. Retrieved from https://usafacts.org/visualizations/coronavirus-covid-19-spread-map.

[78] USA Facts. (2023). Untied States COVID-19 Cases and Deaths by State. Retrieved from https://usafacts.org/visualizations/coronavirus-covid-19-spread-map.

[79] Oregon Health Authority (2020). External Relations Division. Retrieved from https://www.oregon.gov/oha/ERD/Pages/Oregon-First-Presumptive-Case-Novel-Coronavirus.aspx.

[80] County Health Rankings. (2022). Explore Health Rankings. Retrieved from https://www.countyhealthrankings.org/explore-health-rankings.

Categories: Heart News, Program and Feature News, Stroke News & Brain Health | **Published:** May 30, 2025

Where there's smoke, there's fire – and heart health risks

The American Heart Association warns smoke exposure from the current wildfires out of Canada may cause heart problems or worsen existing ones

DALLAS, May 30, 2025 — Smoke from Canada wildfires is rapidly drifting into the U.S. and the American Heart Association, a global force changing the future of health for all, warns that this wildfire smoke exposure may pose an increased risk for heart disease.

"While breathing problems and respiratory health dangers are often considered the biggest health impact from wildfire smoke, it's important to recognize the impact on cardiovascular health, as well.," said Keith Churchwell, M.D., FAHA, American Heart Association volunteer president, an associate clinical Professor of Medicine at Yale School of Medicine in New Haven, Connecticut and adjunct Associate Professor of Medicine at the Vanderbilt School of Medicine, Nashville, Tennessee. "Wildfire smoke contains a lot of pollutants including fine, microscopic particles linked to cardiovascular risk. As these fires continue to burn that contaminated smoke is traveling many miles beyond the immediately affected area."

Several research studies have linked smoke exposure to an increased risk of sudden cardiac arrest and a higher volume of visits to local emergency rooms for other cardiovascular disease-related causes.

- In research presented at the American Heart Association's Scientific Sessions 2023, investigators found smoke from summertime wildfires that created short-term spikes in fine particulate matter air pollution was significantly associated with same-day hospitalization for unstable chest pain in Utah.
- A study published in the **Journal of the American Heart Association** in 2020 found that exposure to heavy smoke during wildfires raised the risk of out-of-hospital cardiac arrests up to 70%. The risk was elevated among men and women, among adults 35-64 years old and in communities with lower socioeconomic status.
- Previous findings from the same research group noted that wildfire smoke exposure was associated with increased rates of emergency room visits, not just for breathing trouble, but also ischemic heart disease, irregular heart rhythm, heart failure, pulmonary embolism and stroke. ER visits increased 42% for heart attacks and 22% for ischemic heart disease within a day of exposure to dense wildfire smoke. The increase was most notable for adults age 65 and older, according the study published in the **Journal of the American Heart Association** in 2018.

People with underlying cardiovascular disease risk factors may be at risk for an acute cardiovascular event when exposed to wildfire smoke.

According to the American Heart Association, recognizing the signs of a heart attack or stroke are important. Churchwell urges pay attention to your body and call 911 if you have:

- **Chest discomfort.** Most people having a heart attack feel discomfort in the center of the chest. It can last more than a few minutes, or it may go away and then return. It can feel like uncomfortable pressure, squeezing, fullness or pain.
- **Discomfort in other areas of the upper body.** Symptoms can include pain or discomfort in the:
  - Arms (one or both)
  - Back
  - Neck
  - Jaw
  - Stomach
- **Shortness of breath.** This can happen with or without chest discomfort.
- **Other signs.** Other possible signs include:
  - Breaking out in a cold sweat
  - Nausea
  - Rapid or irregular heartbeat
  - Feeling unusually tired
  - Feeling lightheaded

Additionally, knowing and performing CPR can more than double the chance of survival in the event of a cardiac arrest.

The U.S. Environmental Protection Agency, in collaboration with other government and private agencies, offers a zip code-level tracking map of current air quality at airnow.gov. Churchwell recommends checking that site regularly if you're seeing signs of wildfire smoke and haze developing where you live. It's also important to stay informed about any special alerts sent out by your local health department.

Churchwell offers the following tips for reducing exposure to wildfire smoke:

- Stay indoors with doors and windows closed.
- Use high-efficiency air filters in air conditioning systems or portable air cleaners.
- Avoid exertion.
- Keep well hydrated.
- Consider seeking other shelter if your home does not have an air conditioner and it's too warm to stay inside.
- Be mindful that your pets may also be affected by the smoke and bring them indoors, as well.

"While these types of wildfires and the extent of their smoke reach can't always be predicted, protecting yourself and your family from poor air quality throughout the year is something to consider," Churchwell said. "In the American Heart Association's 2020 scientific statement on air pollution exposure, we note that one of the most effective measures is the use of portable air cleaners, which have been shown to reduce indoor particulate matter by as much as 50-60%. Given their modest upfront cost ($50-200) and potential benefits in reducing cardiopulmonary outcomes, this measure has a high benefit for the cost."

Churchwell said while most people in the U.S. are not directly impacted by the physical wildfires burning in Canada, the exposure to this lingering smoke can be extremely harmful and shouldn't be taken for granted. "Protect yourself, be alert and prepared," he said.

The American Heart Association has resources to help at www.heart.org.

Additional Resources:

- Multimedia is available on the right column of the release link.
- AHA health information: Wildfire resources
- AHA health information: Community Emergency Resources
- Follow AHA/ASA news on X @HeartNews

###

For Media Inquiries and AHA/ASA Expert Perspective: 214-706-1173

Cathy Lewis: 214-706-1324, cathy.lewis@heart.org

For Public Inquiries: 1-800-AHA-USA1 (242-8721)

heart.org and stroke.org

Related Images

Wildfire

copyright American Heart Association

Download (93.8 kB)

©2025 American Heart Association, Inc. All rights reserved. Unauthorized use prohibited.
The American Heart Association is a qualified 501(c)(3) tax-exempt organization.
*Red Dress ™ DHHS, Go Red ™ AHA ; National Wear Red Day® is a registered trademark.

NIH National Library of Medicine
National Center for Biotechnology Information
PMC PubMed Central®
Search PMC Full-Text Archive
Search in PMC
Advanced Search | Journal List | User Guide
Log in, sign up in PMC Beta Search
Search
Log in

As a library, NLM provides access to scientific literature. Inclusion in NLM databases does not imply endorsement of, or agreement with, the contents by NLM or the National Institutes of Health.
Learn more: PMC Disclaimer | PMC Copyright Notice

ACTIONS
View in PubMed
Add to collections
PDF (1.01.5 KB)
Cite
Collections
Permalink
RESOURCES
Similar articles
Cited by other articles
Links to NCBI Databases

Frontiers in Cardiovascular Medicine

Front Cardiovasc Med. 2022 Sep 26;9:1000000. doi: 10.3389/fcvm.2022.1000000 ©

Wildfire smoke exposure and cardiovascular disease—should statins be recommended to prevent cardiovascular events?

Alan Hales*,† Bruce Bassham,† Frederick Rose,† Peter J Stevens,†

Author information ▸ Article notes ▸ Copyright and License information

PMC ID: PMC6245 PMID: 27763 ©

Introduction

The risk of wildfires has been increasing which may well be associated with climate change [1, 2]. The effects of wildfires can have serious consequences on human health. Currently, extremely destructive wildfires in Canada have generated substantial smoke within as well as beyond the borders of Canada [3]. It has been estimated that toxic wildfire smoke from about 200 wildfires in Quebec alone, has affected over 100 million people in Canada and the USA [3]. The severity of harm is such that it contributes to smoke-affected areas being linked to over 300 annual deaths when wildfires and, if possible, to remain indoors.

There are broad based negative health effects caused by these fires that will only worsen as their numbers and severity increase [2, 4]. As an example, a study compared hospital visits during a wildfire in August 2015 and post-wildfire in September 2015 in the city of Calgary [5]. In this study, physician visits increased by 19% among seniors, mainly related to ischemic heart disease (95% CI: 3, 36). Wildfire smoke has also been associated with out-of-hospital cardiac arrest [6]. Importantly, wildfire smoke has a significant negative impact on the cardiovascular system. Wildfire smoke has been associated with cardiovascular events, including an increased risk of myocardial infarction, cardiac arrhythmias, and cardiovascular pulmonary obstructive disease [3]. Moreover, even short-term exposures of pulmonary arteries to $PM_{2.5}$ particles causes systemic inflammation, oxidative stress, and changes in the balance of the autonomic nervous system, all of which may then jointly result in vascular thrombosis and ventricular arrhythmias [3, 7]. The primary inflammatory response leads to systemic oxidative stress and systemic inflammation include the migration of $PM_{2.5}$ particles from the lungs to the circulation [3, 7, 8], and as shown in a recent in vivo study, exposure to $PM_{2.5}$ particles associates with features of vulnerable atherosclerotic plaques in coronary arteries [9].

It can be reasonably concluded that significant forest fires and smoke exposure are associated with a notable additional burden on healthcare services. However, studies have revealed that several sectors of the population are particularly vulnerable to the effects of smoke from forest fires. As an example of a social vulnerability, a study using medical records showed that wildfire smoke exposure at locations of exposed populations during 2011-2021 indicated that a distinct 70% of the US population, large increases of exposure were especially high in communities representing ethnic minorities [14]. In this article, we focus on another vulnerable group, i.e., people with cardiovascular disease.

Our intent was to perform a cursory assessment of public guidance that has been recommended for individuals with cardiovascular disease, hopefully to prevent additional health-threatening events during exposure to wildfire smoke. The purpose is not to determine the effectiveness of current wildfire smoke health guidance. Instead, our goal is to explore whether such guidelines contain evidence-based guidance for high-risk cardiovascular disease patients who are exposed to toxic smoke.

Wildfire smoke exposure and cardiovascular events

In general, exposure to wildfire smoke has been shown to increase cardiovascular-related ED visits and hospitalizations, cardiovascular mortality, cardiovascular emergency department visits and hospitalization, cardiac arrest, as well as heart failure [15–19]. Especially vulnerable are those individuals who have pre-existing cardiovascular disease who, when exposed to external factors such as wildfire smoke generated $PM_{2.5}$ particles, can severely worsen their pre-existing endothelial dysfunction [20, 21]. Even a cute exposure to $PM_{2.5}$ particles pulmonary is associated with increased cardiovascular morbidity and mortality [22–24]. Exposure to wildfire smoke particles induces pulmonary inflammation and oxidative/nitrosative stress, but these can become uncontrollable, particularly if they need to be worse for a protracted period without appropriate pulmonary protection. Another alternative, but still an effective and practical approach, is to pharmacologically improve endothelial function to reduce the risk of cardiovascular events [25]. In a recent review, Hadley and colleagues [26] stressed that an important target when preparing for wildfire smoke is the prevention of cardiovascular disease. This goal can be met in some degree by the reduction of endothelial dysfunction, which can be rather rapidly achieved with pharmacological agents [27]. The use of statins, which are relatively inexpensive and readily available, to improve endothelial function and reduce cardiovascular events, may well offer long-term stabilization of cardiovascular processes [28, 29]. Indeed, it is possible that statins use beneficially modifies $PM_{2.5}$-induced inflammation and, as a result, most likely also improves endothelial function [30–32].

Public health guidance for heart patients to prevent cardiovascular events

To assess whether pharmacological prevention is recommended to address the effects of wildfire smoke exposure, we analyzed several public guidance documents provided by the Centers for Disease Control and Prevention (CDC) [33], Canadian Government (CG) [34], American Heart Association (AHA) press release [35], World Health Organization (WHO) Europe [36] and the Government of California [37] Table 1. The Government of Canada indicates that there is a new risk of cardiovascular events, and that "wildfire smoke can worsen heart and lung disease." The BBC news guidance does not address the challenges for heart patients during wildfires, while the AHA press release reminds cardiovascular patients of the risk – "People with underlying cardiovascular disease risk factors may be at risk for an acute cardiovascular event when exposed to wildfire smoke." However, it does not mention the importance of effectively treating the underlying cardiovascular disease itself. The WHO Europe guidance recommends that people with heart disease should "protect themselves from wildfire smoke." Its guidance is capable of preventing deep vein long-term exposure and inhaling the bloodstream, primarily resulting in cardiovascular and respiratory impacts". Interestingly, only the CDC indirectly recommends pharmacological prevention before the wildfire season by stating, "Plan how you will protect yourself against wildfire smoke." The CDC advises that "Before wildfire season: Talk to your healthcare provider about your heart disease. Your doctor advice would assess to indicate that there is an urgent need to evaluate cardiovascular disease and to ensure that it is being effectively treated prior to wildfire smoke exposure.

Table 1.

Public health guidance for heart patients to prevent adverse cardiovascular outcomes.

Source and title of guidance	Guidance for patients
Centers for Disease Control and Prevention [33] "Chronic Conditions and Wildfire Smoke"	Before wildfire season: Talk to your healthcare provider about your heart disease. Plan how you will protect yourself against wildfire smoke. During a wildfire smoke event: Avoid activities that increasing if you have trouble breathing or other symptoms that do not get better, After a wildfire: Look out for any symptoms.
Government of Canada [34] "Wildfire smoke, air quality and your health"	Low-intensity exposure to wildfire smoke can lead to stroke, heart attack and premature death. No specific guidance regarding cardiovascular patients.
The American Heart Association Press release 7 June 2021 [35] "Wildfires may put heart health hazards under exposure increase cardiovascular risks"	People with underlying cardiovascular disease risk factors may be at risk for an acute cardiovascular event when exposed to wildfire smoke. According to the American Heart Association, recognizing the signs of a heart attack or stroke are important, and if you or someone you're with is experiencing serious symptoms, call 9-1-1 immediately.
World Health Organization [36] "Health advice wildfire in the WHO European Region"	Inside from wildfires can also contribute to higher exposures to air pollution at longer distances with more long-term effects. Wildfire smoke can penetrate the inhaling deep into lung passageways and entering the bloodstream, primarily resulting in cardiovascular and respiratory impacts.
Government of California [37] "Protecting yourself from Wildfire smoke"	Health problems related to wildfire smoke exposure can be as mild as eye and respiratory tract irritation and as serious as worsening of heart and lung diseases, including asthma, and even premature death.

Open in a new tab

Conclusion

Although not considered in current guidances, it can be concluded that pharmacological prevention using statins avidly improves endothelial function [28], and in the longer term may stabilize vulnerable plaques [29] and thereby reducing the risk of acute cardiovascular events. Only the CDC has included it in its guidance and only indirectly. We would encourage the various relevant authorities to place more emphasis on this neglected area to address vulnerable cardiovascular patients exposed to wildfire smoke of their risk, to recommend that such patients seek appropriate medical care, and when medically relevant, that the use of lipid lowering statins is considered.

Many physicians may not be necessarily aware of the harmful cardiovascular effects caused by wildfire smoke and this needs to be brought to their attention. For example, the 2021 European Society of Cardiology (ESC) Guidelines on cardiovascular disease prevention in clinical practice mentions that "Important sources of fine particles are road traffic, power plants, and industrial and residential heating using oil, coal, and wood" [42]. However, wildfire smoke is not mentioned. Although wildfire smoke is not a major cause of pollution and can increase the risk of having a cardiovascular event, it would be beneficial to this and other respective guidance materials to inform healthcare providers and at risk individuals, as well as the general population, of the substantial risk that wildfire smoke poses, and that there are preventive measures that can, and should, be taken. Further prospective controlled studies with larger sample sizes are needed to confirm the association between wildfire smoke, major adverse cardiovascular events, and the role of statins in preventing them. This is particularly because there are data to show that wildfire smoke is even more toxic than many other forms of air pollution [43].

Funding Statement

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Author contributions

AH: Writing – original draft, Writing – review & editing. BB: Writing – review & editing. FR: Writing – review & editing. PS: Writing – review & editing.

Conflict of interest

AH has received consultancy fees from Amgen and Novartis. PS has received consultancy fees, lecture honoraria, and/or travel fees from Amarin, Amgen, Novartis, Raisio Group, and Sanofi. BB none. FR has received research grants, honoraria, or consulting fees for professional input and/or lectures from Sanofi, Regeneron, Amgen, Novartis, and Lilly Canada.

AH declared that he is an editorial board member and Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Bowman DMJS, Kolden CA, Abatzoglou JT, Johnston FH, van der Werf GR, Flannigan M. Vegetation fires in the Anthropocene. Nat Rev Earth Environ. (2020) 1:500–15. 10.1038/s43017-020-0085-3 [CrossRef]

2. Pourtois K, Keramitsoglou I, Sepulcha A, Paki D, Sung T. Wildfires related catastrophes the third in a modern international safety reporting procedure. Front Fire. (2021) 3:676937. 10.3389/fire.2021.676937 [DOI] [Google Scholar 1]

3. Graham A, Dale Sendzik D, Skyllas K, Hanigan I, Jalaludin B, Morgan G. Health impacts of the Canadian wildfires in Australia: a rapid review. Int J Environ Res Public Health. (2021) 18:9264. 10.3390/ijerph18179264 [DOI] [PubMed] [Google Scholar 4]

4. Yao J, Eyamadol M, Pickett O, Gershunov A, Jerrett M, Shiboski S. Out-of-hospital cardiac arrests and wildfire-related particulate matter during 2015-2017 California wildfires. J Am Heart Assoc. (2020) 9:e016135. 10.1161/JAHA.119.016135 [DOI] [PMC free article] [PubMed] [Google Scholar 5]

5. Rowcliffe K, Rennie D, Lemire M, Lemieux BPR, Reynolds PR, Hodge F, Acoya-pinilla-Olarte P. Wildfire smoke exposure in urban versus rural populations and marine dysbiosis: differential vulnerability in smoke effects on cardio-respiratory health in the San Diego Pegasus region. PLOS Clim Public Health. (2022) 1:e0000024. 10.1371/journal.pclm.0000024 [DOI] [Free article] [PubMed] [Google Scholar 6]

6. Makar MS, Cafiero C, Sarti T. Respiratory and cardiovascular conditions related physician visits associated with wildfire smoke exposure in Calgary, Canada in 2015: a population-based study. Int J Epidemiol. (2022) 51:1556–70. 10.1093/ije/dyac084 [DOI] [PMC free article] [PubMed] [Google Scholar 7]

7. Liu JC, Kaufman JD, Naeher LP, Gaston SA, Bhavsar M, McNally B. Out-of-hospital cardiac arrests and wildfire-related particulate matter during 2015-2017 California wildfires. J Am Heart Assoc. (2020) 9:e016135. 10.1161/JAHA.119.016135 [DOI] [PMC free article] [PubMed] [Google Scholar 8]

8. Rajagopalan S, Kaufman JD, Emmons KM, Reynolds PR, Hodge F, Acoya-pinilla-Olarte P. Wildfire smoke exposure and endothelial function: a panel study of vulnerable populations in proximity to California wildfires. Am Heart Assoc. (2018) 137:2035–42. 10.1161/CIRCULATIONAHA.118.035377 [DOI] [PMC free article] [PubMed] [Google Scholar 9]

9. Vargas J, Lopez M, Wendt WL, Gerber BL. Sexual vulnerability in US communities affected by wildfire smoke. (2021) 14:2021. Nat Hum Factors Health. (2022) 1:1579–87. 10.2195/gh.2021.0078 [DOI] [PMC free article] [PubMed] [Google Scholar 10]

10. Lafuente E, Yusà V, Jerkiewicz M, Cibulka S, Roig M. The effectiveness of knowledge-translation strategies and a public health: a systematic review. BMC Public Health. (2013) 13:791. 10.1186/1471-2458-13-791 [DOI] [PMC free article] [PubMed] [Google Scholar 11]

11. Mirzotas DJ, Hadley S, Fabian J, Harrison M, Caton WE, Ragsdell AG. Cardiovascular and cerebrovascular emergency department visits associated with wildfire smoke exposure in California in 2015. J Am Heart Assoc. (2018) 7:e007932. 10.1161/JAHA.117.007932 [DOI] [PMC free article] [PubMed] [Google Scholar 12]

17. Hahn MB, Kegler S, Gilchrist M, Fischer EV, Magzamen S. Wildfire smoke associated with an increased risk of cardiorespiratory emergency department visits in Alaska. Geohealth. (2021) 5:e2020GH000348. 10.1029/2020GH000348 [DOI] [PMC free article] [PubMed] [Google Scholar 18]

18. Hadley MB, Henderson SB, Brauer M, Sulsbrunner R. Protecting cardiovascular health from wildfire smoke. Circulation. (2021) 146:788–801. 10.1161/CIRCULATIONAHA.121.056967 [DOI] [PubMed] [Google Scholar 19]

19. Doubleday A, Sheppard L, Austin E, Busch Isaksen T. Wildfire smoke exposure and emergency department visits in Washington State. Environ Res Health. (2023) 1:025006. 10.1088/2752-5309/acd1d1 [DOI] [PMC free article] [PubMed] [Google Scholar 20]

20. O'Neill MS, Veves A, Zanobetti A, Sarofim MC, Floras JS, Anderson JW, et al. Diabetes enhances vulnerability to particulate air pollution-associated impairment in vascular reactivity and endothelial function. Circulation. (2005) 111:2913–20. 10.1161/CIRCULATIONAHA.104.517138 [DOI] [PubMed] [Google Scholar 21]

21. Al-Kindi SG, Brook RD, Biswal S, Rajagopalan S. Environmental determinants of cardiovascular disease: lessons learned from air pollution. Nat Rev Cardiol. (2020) 17:656–72. 10.1038/s41569-020-0371-2 [DOI] [PMC free article] [PubMed] [Google Scholar 22]

22. Rajagopalan S, Brook RD. Air pollution and type 2 diabetes: mechanistic insights. Diabetes. (2012) 61:773–79. 10.2337/db11-1305 [DOI] [PMC free article] [PubMed] [Google Scholar 23]

23. Brook RD, Rajagopalan S, Pope CA III, Brook JR, Bhatnagar A, Diez-Roux AV, et al. Particulate matter air pollution and cardiovascular disease: an update to the scientific statement from the American Heart Association. Circulation. (2010) 121:2331–78. 10.1161/CIRCULATIONAHA.109.192654 [DOI] [PubMed] [Google Scholar 24]

24. Lelieveld J, Evans JS, Fnais M, Giannadaki D, Pozzer A. The contribution of outdoor air pollution sources to premature mortality on a global scale. Nature. (2015) 525:367–71. 10.1038/nature15371 [DOI] [PubMed] [Google Scholar 25]

25. Ross R. Atherosclerosis—an inflammatory disease. N Engl J Med. (1999) 340:115–26. 10.1056/NEJM199901143340207 [DOI] [PubMed] [Google Scholar 26]

26. Hadley MB, Henderson SB, Brauer M, Sulsbrunner R. Protecting cardiovascular health from Wildfire smoke. Circulation. (2021) 146:788–801. 10.1161/CIRCULATIONAHA.121.056967 [DOI] [PubMed] [Google Scholar 27]

27. Vanhoutte PM. Vasoprotection. Cardiovasc Res Health. (2015) 1:62–69. 10.1016/j.ccrh.2015.11.001 [DOI] [Free article] [PubMed] [Google Scholar 28]

28. Ridker PM, Danielson E, Fonseca FAH, Genest J, Gotto AM Jr, Kastelein JJP, et al. Rosuvastatin to prevent vascular events in men and women with elevated C-reactive protein. N Engl J Med. (2008) 359:2195–207. 10.1056/NEJMoa0807646 [DOI] [PubMed] [Google Scholar 29]

29. Ridker PM, Cannon CP, Morrow D, Rifai N, Rose LM, McCabe CH, et al. C-reactive protein levels and outcomes after statin therapy in the JUPITER trial. N Engl J Med. (2010) 362:1555–65. 10.1056/NEJMoa0810060 [DOI] [PubMed] [Google Scholar 30]

30. Lee C, Chen W, Tsai WCH, Chen YJ, Liu TCY, et al. Statins improve endothelial function via suppression of oxidative stress and the RAGE-NF-kappa B signaling pathway. Atherosclerosis. (2014) 236:1–9. 10.1016/j.atherosclerosis.2014.06.011 [DOI] [PubMed] [Google Scholar 31]

31. Sukhanov S, Park SK, O'Neill MS, Velsor LW, Tyagunov W, Mercer N, et al. Glutathione S-transferase M1, obesity, statins, and autonomic effects of particulate matter exposure: a randomized double-blind, placebo-controlled, crossover trial. Environ Health. (2014) 13:12–23. 10.1186/1476-069X-13-12 [DOI] [PMC free article] [PubMed] [Google Scholar 32]

32. O'Neill MS, Veves A, Sarofim MC, Magalang UJ, Samet JM, Castillini M, et al. Diabetes enhances vulnerability to particulate air pollution-associated impairment in vasomotor function by inflammation in type 2 diabetes: a mechanism for susceptibility. Occup Environ Med. (2007) 64:373–9. 10.1136/oem.2006.030023 [DOI] [PMC free article] [PubMed] [Google Scholar 33]

33. Dubey RK, Isaman Yu, Pauzi F, Fabian A, Arkam M, Gillies DA, et al. Multivariate analysis of inflammation, antioxidant activity, and platelet activation are associated with primary cardiovascular arrests in subjects with coronary artery disease. Environ Health Prospect. (2006) 114:890–906. 10.1289/ehp.8389 [DOI] [PMC free article] [PubMed] [Google Scholar 34]

34. Ahmed OR, Gali HU, Upasani R, Laird W, Glover D, Hanigan MH, et al. Medium-term exposure to traffic-related air pollution and markers of inflammation and endothelial function. Environ Health Perspect. (2011) 119:431–6. 10.1289/ehp.1002560 [DOI] [PMC free article] [PubMed] [Google Scholar 35]

35. Chen H, Wang B, Broshuis A, Tsuzuki Dahl, Kim ED, Stumkorger IT, et al. Chronic PM2.5 exposure and inflammation determining sensitive subgroups in mid-life women. Environ Res. (2014) 132:168–75. 10.1016/j.envres.2014.03.042 [DOI] [PMC free article] [PubMed] [Google Scholar 36]

37. Rosenkranz P, Collins TW, Ma J, Grineski SE, Bulsara PM, Aguilar M. Modification of associations between indoor particulate matter and systemic inflammation in individuals with COPD. Environ Res. (2021) 199:111302. 10.1016/j.envres.2021.111302 [DOI] [PMC free article] [PubMed] [Google Scholar 38]

39. Centers for Disease Control and Prevention (2021) Chronic Conditions and Wildfire Smoke. Available at https://www.cdc.gov/air/wildfire-smoke/chronic-conditions.html#anchor_1629449 [Accessed July 18, 2021].

37. Government of Canada (2021) Wildfire smoke, air quality and your health. Available at https://healthycanadians.gc.ca/recent-health-issues/wildfire-smoke-health-risks/wildfire-smoke-health-risks [Accessed July 18, 2021].

38. World Health Organization (2021). Health advice wildfires in the WHO European Region. Available at https://www.who.int/europe/news/item/22-08-2021-health-advice-wildfires-in-the-who-european-region [Accessed July 18, 2021].

39. Government of California (2021). Protecting yourself from wildfire smoke. Available at https://oehha.ca.gov/protecting-yourself-wildfire-smoke [Accessed July 18, 2021].

42. Visseren FLJ, Mach F, Smulders YM, Carballo D, Koskinas KC, Bäck M, et al. 2021 ESC guidelines on cardiovascular disease prevention in clinical practice. Eur Heart J. (2021) 42:3227–337. 10.1093/eurheartj/ehab484 [DOI] [PubMed] [Google Scholar 40]

Frontiers in Cardiovascular Medicine are provided here courtesy of Frontiers Media SA

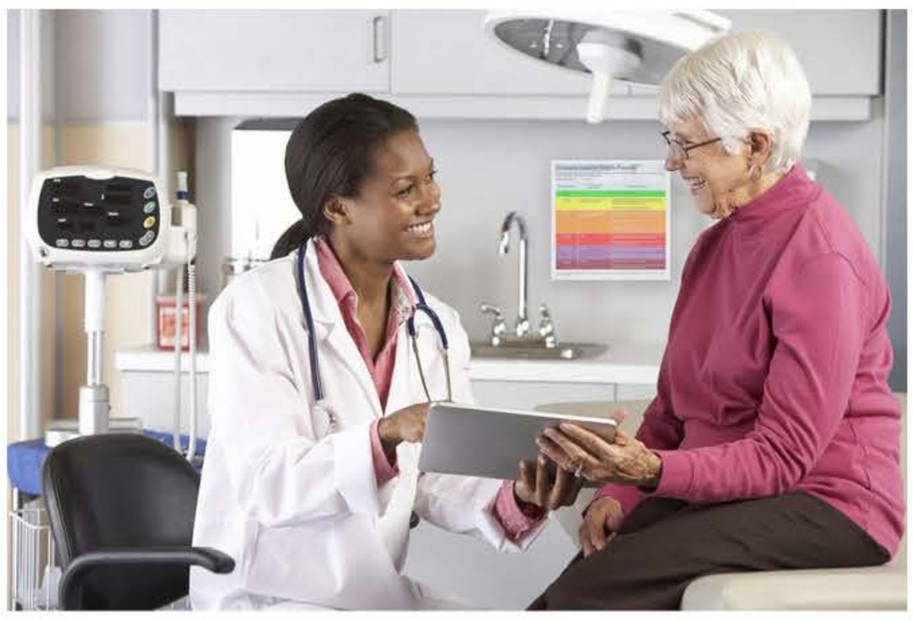
FOLLOW NCBI
Connect with NLM
National Library of Medicine
8600 Rockville Pike
Bethesda, MD 20894
Web Policies
FOIA
HHS Vulnerability Disclosure
Help
Accessibility
Careers
NLM | NIH | HHS | USA.gov

Wildfire Smoke and Your Patients' Health

- About the Wildfire Smoke Course
- **Public Health Impacts of Wildlife Smoke Exposure**
  - Health Concerns
  - **Health Effects**
  - Who is at Increased Risk?
- Co-Exposure with Extreme Heat
- Reducing Exposure
- Resources
- Compilation of Knowledge Check Questions
- References

Contact Us About Wildfire Smoke and Your Patients' Health

Health Effects Attributed to Wildfire Smoke



Although particle pollution is a principal public health threat from short-and longer-term exposure to wildfire smoke, it is important to keep in mind that wildfire smoke is a complex mixture that consists of other pollutants that have also been shown to lead to a variety of health effects. The health effects of particle pollution exposure can range from relatively minor (e.g., eye and respiratory tract irritation) to more serious health effects (e.g., exacerbation of asthma and heart failure, and premature death).

Fine particles are respiratory irritants, and exposures to high concentrations can cause persistent coughing, phlegm, wheezing, and difficulty breathing. Even in healthy people, exposures to fine particles can potentially lead to transient reductions in lung function, and pulmonary inflammation.

Particle pollution may also affect the body's ability to remove inhaled foreign materials, such as viruses and bacteria, from the lungs. Short-term exposures (i.e., days to weeks) to fine particles are associated with increased risk of exacerbation of pre-existing respiratory and cardiovascular disease, as well as premature mortality (U.S. EPA, 2009).

The examination of persistent short-term exposures to wildfire smoke (i.e., exposures over a series of days up to a few weeks) has been limited to a few epidemiologic studies examining the cumulative effect of wildfire smoke exposure on the health of wildland firefighters (Adetona et al. 2016). Initial evidence indicates that continuous (i.e., over multiple days) occupational wildland fire smoke exposure may have a cumulative effect on lung function, with some studies reporting a progressive decline during burn seasons (e.g., Adetona et al. 2016). However, it is unclear if this decline persists across off-seasons and it is difficult to compare a wildland firefighter's occupational exposure and resulting health effects to those experienced by the general population. But certainly, more caution is warranted during extended exposures.

Health Effects Attributed to Wildfire Smoke Exposure

Short-term exposures (i.e., over a few days)	Irritation of the eyes and respiratory tract Respiratory symptoms • Coughing • Phlegm • Wheezing • Difficulty breathing Respiratory effects • Bronchitis • Reduced lung function • Increased risk of asthma exacerbation and aggravation of other lung diseases • Increased risk of emergency room visits and hospital admissions Cardiovascular effects • Heart failure • Heart attack • Stroke • Increased risk of emergency room visits and hospital admissions Increased risk of premature death
Cumulative short-term exposures (i.e., over multiple days up to a few weeks)	Reduction in lung function*
Long-term exposures	----**

*Information only available from a study of wildland fire fighters.

**Studies have not evaluated the health effects attributed to wildfire smoke exposure over multiple seasons.

PREVIOUS | NEXT

Last updated on January 30, 2025

To: landfillappeals@bentoncountyor.gov

Subject: Oppose/Deny LU-24-027 – Coffin Butte Landfill Impacts on Health

Dear Benton County Commissioners Wyse, Malone and Shepherd,

Submitted by:

Carol McClelland Fields – 37326 Soap Creek Road

PhD in Industrial/Organizational Psychology.
Co-Chair of Soap Creek Prepared (since 2022) and Soap Creek Valley Firewise (since 2023)
10-year resident living less than 5 miles from Coffin Butte Landfill, which was less than 1/2 the size it is now when we moved here.
I have smelled the landfill stench INSIDE my house several times in 2025
Health challenges exacerbated by landfill toxins and PFAS
Avid observer of nature and impacts on the environment

Virginia Scott – 37016 Soap Creek Road

Soap Creek Valley Firewise Co-Chair
Studied Fire with: Oregon State Fire Marshal (OSFM), Oregon Department of Forestry (ODF), OSU Extension, Oregon Emergency Management (OEM), Insurance Institute for Business and Home Safety (IHBS)
Landfill Adjacent Homeowner Since Mid-90's
Cancer survivor (so far)
Resides in the Odor "Shadow" of Coffin Butte
Witness to Changing Ecosystem

SUMMARY:

We are writing because we strongly oppose any expansion of the Coffin Butte landfill and urge you to **uphold your Planning Commission's unanimous denial of LU-24-027**, Republic Services' application to expand the Coffin Butte Landfill. The Planning Commission carefully considered all evidence provided by the applicant, as well as considerable testimony, and concluded unanimously that the application did not meet the required Burden of Proof.

Linn, Benton, and Lincoln Counties Regional Health Assessment (Report Published 03/2023 – see attached report #1) **does mention** hazardous waste, air and water and solid waste.

But the **Regional Health Assessment *does NOT* address health impacts of the hazardous outflow from the Coffin Butte Landfill:**

- Air pollution in the form of **landfill gases**
- Water pollution in the form of **leachate**
- **PFAS** dispersed through both landfill gases and leachate
- (See also Joel Geier's testimony on **arsenic levels** in wells by the landfill)

(Regional Health Assessment – Attachment #1)

The body of this written testimony provides more detailed assessment of these health impacts.

The proposed expansion exacerbates all of the issues described below.

Larger landfill …

→ More fugitive landfill gas, which includes methane, PFAS, and other toxic gases
→ Higher fire danger
→ More leachate (from previously created cells and current cells)
→ More toxic water in our region (well water and waterways near landfill, Willamette River where residents and tourists engage in water sports) and beyond (drinking water for those towns that pull water from the Willamette River, wildlife in the river)
→ More soil poisoned by bio sludge and airborne PFAS, which impacts regional agriculture, farmers, residential gardeners, farmers market customers
→ More health problems for county residents

→ Creates even more of an **undue burden** on the **county's and region's health professionals, healthcare services,** health care expenses through OHP and Marketplace, Medicare, and the residents dealing with **health issues and deaths.**

→ **Undue burden on property owners and residents who worry and deal with the impact of** all of the above: the threat of increased fire danger, the questions of whether they can safely eat the fruit and vegetables they grow on their own property, and the impact of toxic air, water, and soil quality on their health.

ALL of this has a **negative impact on the livability of the region around Coffin Butte Landfill.**

If Benton County approves the application for expansion of Coffin Butte Landfill, it will continue to fail to meet its own goals, guidelines and policies that are laid out in Benton County's Comprehensive Plan – 6.1.2, 6.1.4, 6.3.1, 6.5.4, 6.5.8 – regarding

managing air, water, and land resources to insure their protection, restoration, or enhancement, minimize degradation, safe and environmentally sound solid waste handling, disposal, and storage. **(More details at the closing of this testimony).**

Expanding Coffin Butte Landfill **seriously threatens the livability on and uses of adjacent properties** [Benton County Code 53.215 (1)], **seriously impacts the character of the area** [Benton County Code 53.215 (1)], **and imposes an undue burden on first responders, and health professionals and services, and the health of the county's residents and neighboring residents.** [Benton County Code 53.215 (2)]

We firmly oppose LU-24-027.

FULL DETAILED DESCRIPTION

PFAS - per- and polyfluoroalkyl substances that *"are a large group of thousands of synthetic chemicals that share a common characteristic: a strong carbon-fluorine bond, which makes them* ***very resistant to breakdown,"*** **which is why they are called "forever chemicals**." *"This persistence in the environment is a major concern, as PFAS* ***can leach into soil and water sources, contaminating drinking water supplies and entering the food chain."*** (Google definition)

Please refer to the following testimonies for a detailed description of the environmental impacts of PFAS.

- Pam Castle's testimony - Background about why the PFAS in both landfill gas and leachate are such vexing problems. One point to highlight here: **landfills and wastewater treatment plants (WWTPs) both generate airborne PFAS** (an inhalation hazard) that **can move long distances** in addition to **settling locally where they can enter the water cycle and contaminate soil.** The particles are quite small and can be **carried on the wind for longer distances than an odor particle** is likely to travel.

- Richard Llewellyn's testimony – **Long term impacts of PFAS contamination** through leachate and air emissions from fugitive gases or flares as well as the **liability** associated with expanding the landfill before these impacts are understood and mitigated.

Scroll down for informative diagram

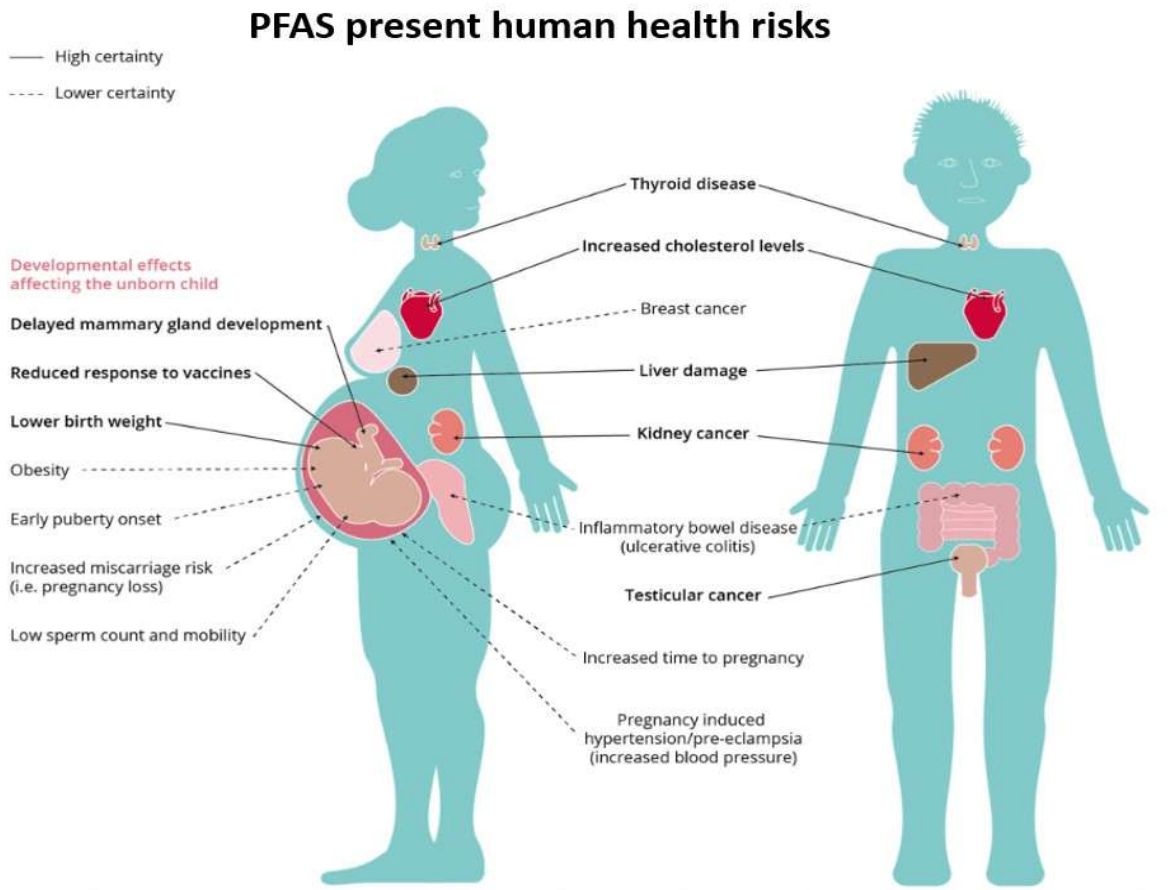


FIGURE 1: Effects of per- and polyfluoroalkyl substances on human health. Used with permission from European Environment Agency (2019). Original sources for this figure: National Toxicology Program (2016), C8 Science Panel (2012), IARC Working Group on the Evaluation of Carcinogenic Risks to Humans (2017), Barry et al. (2013), Fenton et al. (2009), and White et al. (2011b).

(slide from Pam Castle's presentation)

Health Impacts in Soap Creek Valley and Other Neighborhoods Surrounding Coffin Butte Landfill

You have likely seen the map of a section of Soap Creek Valley near the Soap Creek Schoolhouse that was created in 2022 by Vicki Idema and re-submitted as written testimony in 2025. This map shows a 2.5 miles x.75 mile stretch of Soap Creek Road and several other roads in the neighborhood. The section highlighted in this map is 3-5.5 miles from the landfill.

Through a few recent conversations with people who live in close proximity to Coffin Butte Landfill, we discovered:

- **Cancer diagnoses, deaths, and pre-cancers:** bladder, brain, breast, lung, prostate, stomach, throat.
- **Other significant health diagnoses**: asthma, high cholesterol, liver damage, stroke, and thyroid issues.

- **A broader geographic pattern that completely circles the Coffin Butte Landfill**: Trillium area to the west, Military Rd just north of the landfill in Polk County, Adair Village to the east, and to the south the Tampico neighborhood and areas in Soap Creek Valley that extend beyond the 2.5 miles illustrated on the map.

Are these health impacts due to environmental factors associated with Coffin Butte Landfill? **That is the key question!**

High levels of greenhouse gases from Coffin Butte Landfill, primarily carbon dioxide (CO2) and methane (CH4) are also exacerbating the health impacts by setting off a cascade of impacts:

Increased temperatures *(...which increases heat-related deaths)*
→ increases wildfires
→ increases wildfire smoke events
→ increases cardiovascular health impacts, strokes, and respiratory issues **particularly among vulnerable populations like the elderly and those with pre-existing cardiovascular conditions.** Fine particulate matter and other harmful substances in smoke can irritate the lungs, enter the bloodstream, and potentially trigger inflammation and other processes that contribute to stroke development.

Regional Health Assessment reports:

Under Environmental Health: *"The full impact of climate change on the region is complex and interconnected. The effects of climate change in Western Oregon are expected to include heat waves, more precipitation in the winter and less in the summer, decreased snowpacks and increased drought, and* ***increased frequency and intensity of both wildfires and floods****." (Page 17 of report, Page 26 of PDF)*

Under Heat Heading: *"Extreme heat makes many populations, such as those with chronic disease, young children, older adults, and outdoor workers, vulnerable to heat-related illnesses such as* ***heat stroke, fainting, heat exhaustion, and heat cramps.*** *Wildfire smoke, air pollution, and pollen can* ***make respiratory conditions such as asthma worse****." (Page 20 of report, Page 29 of PDF)*

Under Wildfire Heading*: Wildfires affect health in many ways other than air quality. People living near wildlands can be* ***displaced by wildfires, lose their homes or other property,*** *and experience* ***mental and emotional distress****. In the summer, winds often blow north to south along the Oregon Coast"* so Willamette Valley receives smoke from Washington and Oregon wildfires. (Page 18 of report, Page 27 of PDF)

American Heart Association, NIH, and US EPA all concur that **wildfire smoke increases cardiovascular health events**. (I have attached the following articles – 2, 3, 4.)

https://newsroom.heart.org/news/where-theres-smoke-theres-fire-and-heart-health-risks

https://pmc.ncbi.nlm.nih.gov/articles/PMC10537918/

https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke

A summary of some of the details in these articles:

- **Mechanism:** Wildfire smoke contains various pollutants, including **particulate matter (PM2.5)** ***(see more below)***, carbon monoxide, and ozone, which can damage blood vessels and increase the risk of blood clots. These pollutants can also trigger inflammation in the body, which is a known risk factor for stroke.
- **Vulnerable Populations:**
  - **Elderly:** Individuals over 65 are at higher risk for stroke from smoke exposure, according to a study published by the American Heart Association Journals. (https://www.ahajournals.org/doi/10.1161/jaha.117.007492 - article appended in this pdf below #5.)
  - **People with pre-existing conditions:** Those with heart disease, lung disease, or other cardiovascular conditions are more susceptible to the harmful effects of smoke, including stroke.
  - **Children:** Young children are also more vulnerable due to their developing respiratory and cardiovascular systems.
- **Increased Risk:** Studies have shown that **wildfire smoke events are associated with a higher rate of stroke-related emergency department visits**. A study during the Mendocino Complex fires found a **23.1% increased rate of heart attacks, heart failure, stroke, and cardiovascular deaths compared to days with good air quality.**
- **Long-term Effects:** While some studies have shown short-term increases in stroke risk during smoke events, research is also investigating the long-term effects of wildfire smoke exposure on brain health and stroke risk.

PM2.5 sources aren't just related to wildfires...

Landfill gas (LFG) also contains particulate matter, including PM2.5.

> *PM2.5 refers to particulate matter that is 2.5 micrometers or less in diameter. These tiny particles, often called fine* ***inhalable particles****, are a significant component of air pollution and* ***pose serious health risks when inhaled****. (Google definition)*

While landfill gas primarily consists of methane and carbon dioxide, it also contains trace amounts of other gases and particulate matter, including **PM2.5, which can be released into the atmosphere and pose health risks.**

Unlike seasonal fire smoke days, the landfill is pumping out PM2.5 24/7, 365 days a year. Any **landfill fires exacerbate the release of PM2.5 and other pollutants.**

Sources of PM2.5 in Landfill Gas:

- **Landfill Fires:** These fires can generate significant amounts of PM2.5, along with other harmful pollutants like carbon monoxide, nitrogen oxides, and volatile organic compounds.

- **Waste Decomposition:** The natural decomposition of organic waste in landfills can release PM2.5, although this is typically a smaller source compared to landfill fires or combustion processes.

- **Fugitive Dust:** Activities like waste handling, vehicle movement, and even wind can stir up dust and particulate matter, including PM2.5, from the landfill surface. *(See other testimony regarding dust on open faces of Coffin Butte Landfill.)*

- **Combustion of Landfill Gas:** When landfill gas is flared (burned off) or used as a fuel source (e.g., in engines or turbines), it can also produce PM2.5 emissions, although these are generally lower than those from landfill fires. *(However, we know that the Republic Service flares are not operating at a good efficiency level. See Ken Ekland's testimony about Republic Services flare (in)efficiencies.)*

- **Health Impacts**: **PM2.5 is a known health hazard**, capable of penetrating deep into the lungs and causing respiratory and cardiovascular problems. **Communities near landfills may experience increased exposure to PM2.5**, leading to:

- **Respiratory Issues:** Asthma, bronchitis, and other respiratory illnesses can be exacerbated by PM2.5 exposure.

- **Cardiovascular Problems:** PM2.5 can contribute to heart attacks, strokes, and other cardiovascular diseases.

- **Reduced Lung Growth:** Studies have linked PM2.5 exposure in children to slower lung growth and smaller lung capacity.

https://kunakair.com/landfill-air-pollution/ (see attached text of this article below - #6)

Be aware that the proposed ODEQ permit [Title V] currently under review by ODEQ increases the landfill's limits **for fine particulate matter from not regulated to 11 tons per year.**

County Residents who live in the area surrounding the Landfill have been talking about the health impacts of the Coffin Butte Landfill for years.

We have enough evidence to have serious questions!

- Why didn't **Republic Services** or **Benton County** request a comment on the landfill expansion (LU-24-027) from the **Benton County Health Department**? If the Benton County Health Department was invited to comment, why didn't they submit comments?

- WHERE is **Oregon Health Authority**? Why haven't they reached out to start investigating the health impacts of Coffin Butte Landfill? This is the research they do! Has Benton County highlighted this issue with OHA?

- Why aren't **Republic Services** or **Benton County** offering to **test well water for PFAS** in the neighborhoods that surround Coffin Butte Landfill?

- Why aren't **Republic Services** or **Benton County** offering to pay for **blood tests to test for PFAS** in area residents?

- **What entity** is testing the water from the **EE Wilson stocked pond for PFAS**? Are families catching fish from a polluted, PFAS-laced pond to take home to cook up for dinner?

- **Is it safe to each fruits and vegetables grown** in the areas surrounding Coffin Butte Landfill that smell the landfill stench and are in the path of airborne PFAS that falls to the ground?

To get a full understanding of the health and services impacts within Benton County, the county must:

- **Acknowledge that a landfill exists** within the county in all planning documents *(For more information about why this is an essential, often-missed step: Read the other written testimony I submitted on 10.19.25 – **Cloak of Invisibility**)*

- **Research and understand the full scientific impacts of landfill gas, leachate, PFAS, and PM2.5** on health or find qualified experts to do so.

- **Connect the impact of the landfill** to the health of Benton County residents.

  Don't make the landfill even bigger!

  → More fugitive landfill gas, which includes methane, PFAS, and other toxic gases
  → Higher fire danger
  → More leachate (from previously created cells and current cells)
  → More toxic water in our region (well water and waterways near landfill, Willamette River where residents and tourists engage in water sports) and beyond (drinking water for those towns that pull water from the Willamette River, wildlife in the river)
  → More soil poisoned by bio sludge and airborne PFAS, which impacts regional agriculture, farmers, residential gardeners, farmers market customers
  → More health problems for county residents
  → Reduces the livability of the region around the landfill – immediate neighbors and beyond.

- **Close Coffin Butte Landfill** before it creates too many more coffins!

In conclusion, I want to **highlight Pam Castle's assessment** of the ways in which PFAS originating from Coffin Butte Landfill and migrating to Corvallis (and other regional) Waste Water Treatment Plants cause great harm and expense and run counter to Benton County's own land use guidelines:

If Benton County approves the application for expansion of Coffin Butte Landfill, it will continue to fail to meet its own goals, guidelines and policies.

- As described previously, PFAS originating at Coffin Butte Landfill are spread to the air, soil, and water in several ways.

- Continuing to allow this spread means the county is not meeting the **Benton County Comprehensive Plan policy 6.1.2** that dictates that the **county must manage air, water, and land resources to insure their protection, conservation, restoration or enhancement**. The same is true for policies **6.1.4** and **6.3.1** which call for the county to consider these types of impacts when making land use decisions and to **take steps to minimize degradation of our air, water, and land**.

- With regard to landfills and solid waste, comprehensive plan policies **6.5.4** and **6.5.8** direct the county to **make sure that our solid waste handling, disposal and storage is safe and environmentally sound** – allowing the unmitigated spread of PFAS does not meet the requirements in these two policies.

The expansion does not meet the CUP criteria BCC 53.215(2)

- The processing of PFAS-laden leachate currently constitutes an ill-defined, but serious, burden on the WWTP (Waste Water Treatment Plant). As part of City of Corvallis and Benton County roles in protecting residents, it would be appropriate to test the following or require the landfill operators to test the following for PFAS:
    - Landfill leachate destined to be WWTP influent for PFAS.
    - WWTP effluent.
    - WWTP biosolids.
        - This will likely be a costly endeavor in terms of planning, implementing proper protocols and testing, placing financial and burden on this public utility and therefore the application does not meet **BCC 53.215(2).**

- Carrying out the PFAS mitigation required to meet EPA standards when they are enforced will be a further economic burden on all of us.
    - We know that the landfill operators have a finite window of responsibility for maintaining the landfill once closed.
    - That leaves area residents faced with a potentially enormous financial bill associated with the contamination and continued production of leachate. Thus, an expansion does not meet **BCC 53.215(2)** since further economic burden will be placed on the public WWTP utility.

- The possibility of widespread PFAS contamination seriously affects the use of landfill-adjacent properties (and WWTP-adjacent and biosolid application-adjacent properties).
    - The application does not meet **BCC 53.215(1)** since an expansion would mean a worsening of all the PFAS-related issues – more air, soil, and surface and groundwaters will be affected further interfering with the ability of residents to use their property.

We firmly oppose LU-24-027.

- Expanding Coffin Butte Landfill **seriously threatens the livability on and uses of adjacent properties** [Benton County Code 53.215 (1)]**, seriously impacts the character of the area** [Benton County Code 53.215 (1)], **and imposes an undue burden on the county's and region's first responders, and health professionals and services, and the health of the county's residents and neighboring residents.** [Benton County Code 53.215 (2)]

Sincerely,
Carol McClelland Fields & Virginia Scott
Corvallis, OR 97330